CHAPTER 5

Cardinal Utility Analysis

1. What is the Theory of Consumer Behaviour? What is its Significance?

Ans. To be alive, people need food to eat, clothes to wear, and houses to live in. These are only a few things we need to live. There are many other things needed to be alive, and many more to live a happy and comfortable life. The use of things (goods and services, or commodities) for survival and enjoyment is called consumption. Consumption is also defined as the use of resources for the satisfaction of wants directly. Consumption is an important economic activity as most of the things people do, have the final objective of survival or enjoyment. Economic agents-persons, organizations, institutions etc- who use resources for consumption purposes, are called consumers. Thus, consumers are the economic agents who use goods and services for the direct satisfaction of wants.

The way or manner in which individual consumers acquire goods and services for the purpose of consumption is called consumer behaviour. In other words, consumer behaviour involves the likes and dislikes or choice pattern of individuals regarding the consumption of goods and services. The study of the nature of, and the factors determining, the behaviour, that is, the way of doing things, of a consumer regarding his decisions on how much of each of different goods and services he would like to consume is called the theory of consumer behaviour.

The quantity of a good or service which a person wishes to purchase per period of time is called demand for that good or service. In this sense the theory of consumer behaviour means the study of demand, that is, the nature of demand and the factors determining the quantities of different goods and services demanded by a consumer. For this reason the theory of consumer behaviour is also called the theory of demand.

Significance of Studying Consumer Behaviour

Study of consumer behaviour is important for the following reasons:

1. Consumption is the basic economic activity. Directly or indirectly, almost every economic activity is done for the purpose of consumption.
2. Also, consumption is the largest component of total economic activity of almost all the economies. Thus, the study of consumer behaviour is important for its own sake.
3. For businesses to take decisions regarding production and sale of their products, it is important that they should have sufficient information regarding how their products will perform in the market, that is, how would buyers react to their

products in the market: will they (consumers) buy them or not, what should they (businesses) do so that their sales increase or at least do not decrease.? This information can be obtained by understanding the nature of, and the factors determining, the demand for their products.

4. An important issue studied under microeconomics is the efficient utilization of scarce resources. Efficiency means that the resources available to a nation are organised to produce the maximum possible total output of the type of goods and services that people wish to consume. Since the desire and the valuation of goods and services by the people is an important aspect of this issue, the study of the consumer behaviour or the demand becomes important for this reason also.

2. What are the different approaches to the study of consumer behaviour?

Ans. There are many approaches in economics to the understanding of consumer behaviour. They are broadly grouped into two categories: (*i*) consumer behaviour under certainty, and (*ii*) consumer behaviour under uncertainty. The former is the traditional and commonly used approach. It assumes that a consumer has the perfect knowledge about market conditions. This means that the consumer has full information about the quality, quantity, price and the producers or sellers of the commodity he intends to purchase. Under these conditions there is no risk of making wrong decisions.

As regards consumer behaviour under uncertainty, this is the recently developed, commonly used, more real but much complex approach to the understanding of consumer behaviour. This approach assumes that a consumer does not have full information about the market. The consumer is uncertain about many things so that he faces risks of many kinds including the risk of making wrong decisions.

The earliest approach to the study of consumer behaviour under certainty is called cardinal approach. This approach was developed in the second half of the 19th century.

The cardinal utility analysis was followed by many new and more complicated approaches to the study of consumer behaviour and the process continues. The two most important alternatives to cardinal utility analysis are ordinal utility analysis or indifference curve analysis and the revealed preference theory.

At present there are around a dozen approaches to the study of consumer behaviour and cardinal and ordinal approaches are the oldest and the simplest ones.

3. What is cardinal utility analysis? What are its assumptions?

Ans. People consume goods and services because these have the power to satisfy their wants. When you are hungry, you eat food; when you want to clean your teeth, you need tooth brush and tooth paste; when you want to read or write something, you need book, paper and pen. This want satisfying power of goods and services is called utility. In short, people consume goods and services for the utility these commodities provide to them.

As mentioned above, utility is the want satisfying power of goods and services. In other words, utility is a quality of goods and services by virtue of which our wants are satisfied.

There are two main approaches to the analysis of consumer in economics: cardinal utility analysis, and ordinal utility analysis. Cardinal utility analysis assumes utility to be

a quantifiable concept and hence measurable in cardinal numbers. Cardinal numbers are those numbers which are used for counting purposes like 1, 2, 3 etc. It is because of this assumption that this analysis of consumer behaviour is called cardinal utility analysis. Thus, cardinal utility analysis assumes that a person can say how much utility he derives by consuming a good.

When utility is assumed to be a concept measurable quantitatively then we need some unit of measurement in which it can be expressed. Originally, economists had developed a subjective unit of measurement called 'util'. Util is an imaginary and subjective measure and its value depends on the preferences of a consumer. Thus, according to cardinal utility analysis, a consumer can say that he derives ten utils of utility from the consumption of an ice-cream and he gets twice as much utility from an ice-cream than an orange. But a second person can say that he derives 7 utils of utility from the consumption of an icecream and he gets thrice as much utility from an orange than an ice-cream.

The until, which is a psychological measure of utility, could not be taken as a standard or uniform unit of measurement because its value varied from person to person. It was for this reason that Alfred Marshal, an eminent economist, proposed a new unit of measurement in the form of money. Actually, money itself cannot satisfy our wants. In this sense money has no utility. But it gives us a command over, or power to purchase, other utility yielding goods and services which satisfy our wants. So money has an indirect utility for us; the utility of money is derived from the goods and services it helps us to purchase. Marshal argued that the amount of money which a person is ready to pay for a unit of good rather than be without it, is a measure of utility he derives from that good. This had the advantage of uniformity for all the individuals in the economy; for example, if a person is ready to pay Rs 10 for an ice-cream then the ice-cream gives him Rs 10 worth of utility and if he is ready to pay Rs 50 for half a litre of orange juice then this half a litre of orange juice gives him Rs 50 worth of utility. It also means that half a litre of orange juice gives him more utility than an ice-cream.

Another assumption of cardinal utility analysis is that utilities are independent. It means, utility derived from a good depends on the quantity consumed of that good only and no other good. That is, the satisfaction derived from the use of a good is the result of the consumption of that good only. Neither its consumption affects the utility derived from other goods, nor does the consumption of other goods affect the utility derived from it.

The assumption of cardinal measurement of utility along with the assumption of independent utility leads to another property of utility—utility is additive. It means we can add the utility derived from the consumption of different goods or from the different units consumed of the same good. For example, if a person consumes snacks and cold drink and gets 10 units of utility from snacks and 15 units from cold drink, we can add the utility derived from these two goods to get total utility derived by him which in this case would be $10 + 15 = 25$ units. Similarly, we can add the utility derived from various units of a good to arrive at the total utility obtained from its consumption.

Another important assumption which runs through the cardinal utility analysis is that man is rational. Consumers are viewed as rational decision makers who are only concerned with self interest, making decisions based upon the ability to maximise utility whilst expending the minimum effort.

In order to behave rationally in the economic sense, as this approach suggests, a consumer would have to be aware of all the available consumption options, be capable of correctly rating each alternative and be available to select the optimum course of action.

To summarise, the cardinal utility analysis is based on the following key assumptions:

1. Consumers are rational seeking to fulfil their self interest.
2. Consumers have full or perfect knowledge about market conditions.
3. The satisfaction level or utility of consumers is measured cardinally or in numerical terms.
4. Utility of a good is measured in terms of money.
5. Utility derived from the consumption of a good is independent of the consumption of other goods
6. Utility is additive.

4. Explain the concepts of total utility and marginal utility?

Ans. One of the assumptions of cardinal utility analysis is that utility is additive. The additive nature of utility gives rise to two concepts of utility; one is total utility and the other is marginal utility.

Total Utility

Total utility is the satisfaction derived from consuming some collection of different goods or certain units of the same good. For example, utility from consuming two packs of snacks and one cold drink, utility from consuming three ice-creams etc.

How does total utility change as a consumer increases the consumption of a good, that is, consumes more and more units of a good ? The behaviour of total utility is governed by the law of diminishing marginal utility. To understand this law, lets first explain the concept of marginal utility.

Marginal Utility

Marginal utility is the change in total utility resulting from the consumption of one more or one less unit of a good. It is also defined as the addition to total utility resulting from the consumption of an additional unit of a good or simply as the utility derived from consuming an additional unit of a good. To understand this, consider the following table:

Total Utility		*Marginal Utility*	
Units consumed	***Utility derived***	***Units consumed***	***Utility derived***
One ice cream	10 units	1st ice-cream	10 units
Two ice creams	19 units	2nd ice-cream	19 – 10 = 9 units
Three ice creams	27 units	3rd ice-cream	27 – 19 = 8 units
Four ice creams	34 units	4th ice-cream	34 – 27 = 7 units
Five ice creams	40 units	5th ice-cream	40 – 34 = 6 units

The right hand side of the table gives the utility derived from certain units of a good, say one, two, three etc. Specifically, it says the consumer gets 10 units of utility from consuming one ice cream, 19 units from consuming two ice creams and so on. As mentioned above, this is what is called total utility. Left hand side of the table gives the utility derived from the consumption of successive or additional units of the good. Specifically it shows that 1st ice cream gives 10 units of the utility, 2nd ice-cream gives 9 units of the utility, 3rd ice cream gives 8 units of utility and so on. This is the additional utility derived from additional units of the good and this is how we have defined marginal utility above. Thus, left hand side gives marginal utility of different units of the good.

There are three (simple) formulae to calculate marginal utility of a unit of a good. These are:

1. MU of nth unit = TU of n units – TU of $n - 1$ units, or

MU of nth unit = $TU_n - TU_{n-1}$

Example : Let $n = 4$, so

MU of 4th unit = TU of 4 units – TU of $(4 - 1 = 3)$ units

From the table 2.1 we have:

MU of 4th unit = $34 - 27 = 7$ units

MU of n +1th unit = TU of $n + 1$ units – TU of n units, or

MU of $n + 1$th unit = TU $n + 1$ – TUn

Example : Let $n = 3$, so

MU of $(3 + 1 = 4)$th = TU of $(3 + 1 = 4)$ units – TU of 3 units

From the above table we have :

MU of 4th unit = $34 - 27 = 7$ units

$$MU = \frac{\Delta TU}{\Delta Q}$$

Here Δ (delta) means change in, and Q means quantity consumed of the good. ΔQ is usually taken as 1 unit.

This formula is based on the following definition of marginal utility:

Marginal utility is the change in total utility resulting from a small (one unit) change in the amount consumed of a good.

Example :

When the consumer increases the quantity consumed of the good from 2 to 3 units, ΔQ is 1 and because of this, total utility increases from 19 to 27 units, so ΔTU is 8.

Hence

$$MU = \frac{\Delta TU}{\Delta Q}$$

$$= \frac{8}{1} = 8 \text{ units}$$

5. What is law of diminishing marginal utility? Explain it with the help of a table and a diagram.

Ans. Law of diminishing marginal utility is a very important law brought about by cardinal utility analysis governing consumer buying behaviour. As per the law of diminishing marginal utility, a consumer satisfies his wants in order of their urgency and that he consciously or unconsciously weighs in his mind the price he has to pay for the utility of each product he buys.

The law of diminishing marginal utility states that the utility generated by additional units of a good decreases as an individual consumes more of it. In other words, this law says that the utility gained from consumption of successive units of a good goes on decreasing.

This law is based on the simple psychological observation. On a hot summer day, if you are thirsty and hungry and decide to have some ice creams to quench your thirst and expunge the hunger, the first ice cream will give you a very nice taste. The second ice cream will also have a good taste. But when you eat more and more ice creams, say up to five, you will find that the taste is decreasing, that is, the additional ice creams give you lesser and lesser taste and if you continue eating ice creams, at one time you would not like to have any more. This may not be because your pocket is getting empty but because your desire for ice creams is decreasing: even if the ice creams are given to you free of cost the same thing will happen.

This general tendency of decrease in the utility from the consumption of additional units of a good is called law of diminishing marginal utility. This can be shown with the help of following table:

No. of units consumed	*Total utility*	*Marginal utility*
1	9	9
2	17	8
3	24	7
4	29	5
5	31	2
6	31	0
7	30	– 1
8	28	– 2
9	25	– 3

The table gives us the following information :

When the consumer starts consuming the good, first unit of it gives him the total utility of 9 units. This is also the marginal utility of first unit of the good. When he consumes second unit, his total utility from two units of the good is 17 units. This comprises of 9 units of utility from first unit and 8 units of utility from second unit. Note that the second unit of the good gives him the utility of 8 units only which is less than the utility of 9 units obtained from the consumption of first and is consistent with the law of diminishing marginal utility. This happens till the consumption of 5th unit of the good. Up to the consumption of 5th

unit, marginal utility although decreasing, is positive. Positive utility means that the consumer is getting some positive level of satisfaction from the consumption of the good.

At the consumption of 6th unit, marginal utility is zero. Zero utility means the consumer is not getting any satisfaction from the consumption of 6th unit. Is it possible? Yes, surely. When you go on eating ice creams, a time will come when your desire for ice creams would get satisfied and you would not like to eat ice creams any more. This is the case of zero marginal utility. This is called the point of satiation. Thus, satiation is a situation in which a consumer is fully satisfied from the consumption of goods so that consumption of additional units of a good do not give any pleasure or utility to him.

Beyond 6th unit, that is for 7th, 8th and 9th units of the good marginal utility is negative! *Now what is negative marginal utility* ? Negative utility means instead of giving satisfaction, the consumption of a good gives you dissatisfaction; instead of giving good taste it gives bad taste. When you over-consume anything, say ice creams, you find that it feels bad. One regrets why he consumed so much, why he did not stop earlier. This is negative utility or disutility. The more one consumes beyond the point of zero marginal utility, the more negative utility he experiences.

Diagrammatically, the concept of marginal utility can be shown in the following way. (fig. 5.1)

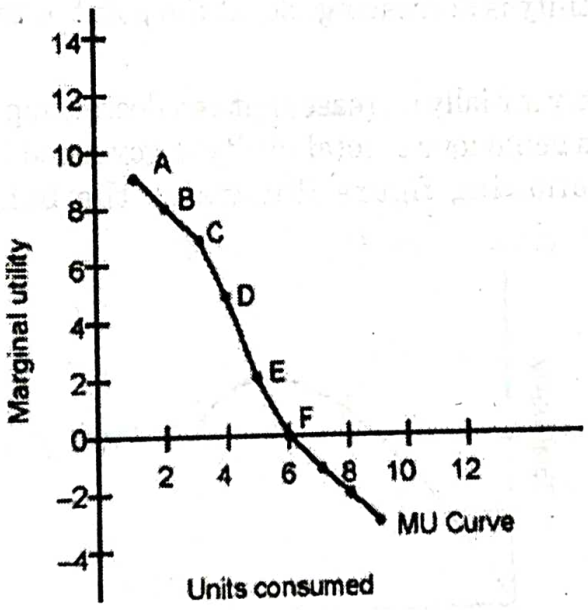

Fig. 5.1

The vertical axis of the graph measures marginal utility and the horizontal axis measures the units of the good consumed. The curve slopes downward from left to right which means marginal utility is falling. 1st unit of the good gives 9 units of utility, 2nd unit gives 8 units, 3rd unit gives 7 units of utility and so on.

6. How does total utility change when consumer increases the consumption of the good?

Ans. The behaviour of total utility depends on the law of diminishing marginal utility. Mathematically speaking, marginal utility is the rate of change of total utility, that is, the pace or speed with which total utility changes. Initially, marginal utility is positive. It

means consumption of additional units is making positive additions to the total utility of the consumer. Hence total utility increases. However, though positive, marginal utility decreases with the increase in the quantity of the good being consumed. It means the additions to the total utility are becoming less and less. This has an important implication: total utility is increasing but at a diminishing or decreasing rate. In the above table, marginal utilities (additions made to total utility) of 1st, 2nd, 3rd, 4th and 5th units are 9, 8, 7, 5 and 2 units respectively. What it implies is that consumption of 1st unit adds 9 units to the total utility, that of 2nd unit adds 8 units, that of 3rd unit adds 7 units and so on. Now it must be clear that addition made by 2nd unit is less than that made by 1st unit and addition made by 3rd unit is less than that made by 2nd unit and so on. This is the meaning of total utility increasing at a diminishing rate.

The marginal utility of 6th unit is zero, that is, the consumption of this unit does not yield any utility to the consumer. So, total utility from 6 units of the good is same (31 units) as total utility from 5 units of the good. Beyond 6th unit, that is, for 7th, 8th and 9th units, utility is negative. This results in the decline in total utility.

Another important point which has to be noted is that total utility is maximum when marginal utility is zero. Before zero marginal utility, marginal utility although decreasing, is positive. Hence total utility is increasing. Beyond zero marginal utility, marginal utility is negative. Hence total utility is decreasing. So, at the point of zero marginal utility, total utility is maximum.

In summary, total utility initially increases but at a decreasing rate, reaches a maximum and begins to decline. This behaviour of total utility is governed by the law of diminishing marginal utility. The following figure illustrates the behaviour of total utility diagrammatically :

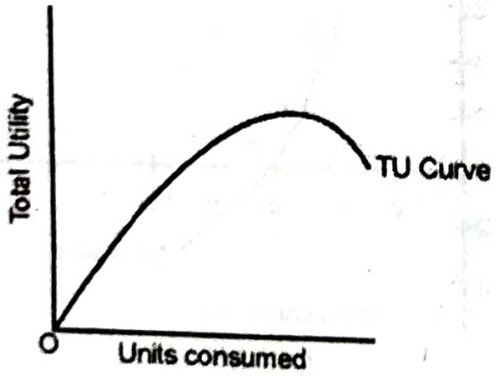

Fig. 5.2

7. How are total utility and marginal utility related?

Ans. There is a specific relationship between marginal utility and total utility. The main points of relationship between total utility and marginal utility are :

- When marginal utility is positive (and diminishing), total utility increases but at a diminishing rate
- When marginal utility becomes zero, total utility becomes maximum or reaches its highest level.
- When marginal utility turns negative, total utility falls.

These points can be elaborated with the help of following diagram

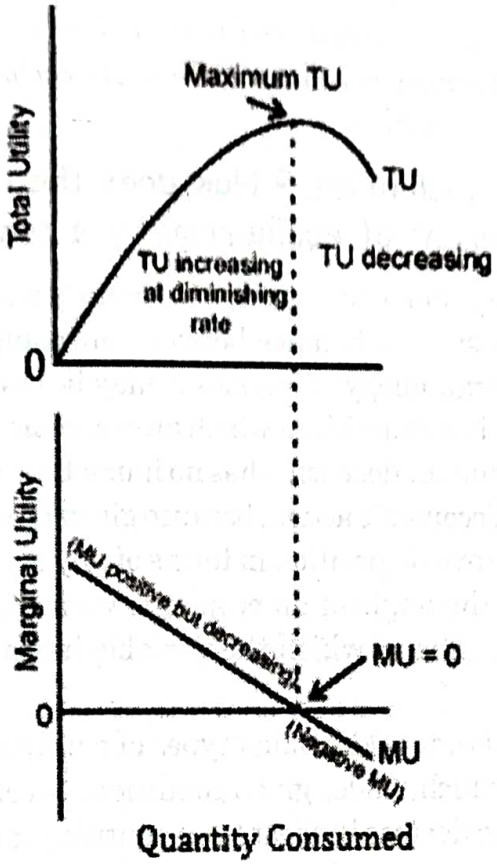

Fig. 5.3

8. Write a short note on marginal utility of money as considered under cardinal utility analysis?

Ans. Law of diminishing marginal utility is valid for almost all commodities: there are very rare exceptions to it. One common exception is that of addiction: If somebody is addicted to something, he may get increasing or at least equal utility from additional units of a good. Economists who developed the cardinal utility analysis made a deliberate exception to the law of diminishing marginal utility. This exception relates to the utility of money. These economists assumed that the law of diminishing marginal utility does not apply to money. In other words, the marginal utility of money remains constant. This was a sort of compulsion for cardinalists. Marshal proposed that money be used as the unit of measurement for utility. But for anything to be used as a unit of measurement, its own value must not change. Imagine using an elastic measuring tap for measuring length. Use of such a measuring tap, the length of which is itself changing, can never be reliable or satisfactory. Thus, if money is supposed to be the measuring rod of utility, then evidently, as with all measuring units, its value must be invariant- it must measure same amount of utility in all circumstances.

An important point, and perhaps the very important to be noted is that when money is used as a unit of measurement for utility, a given amount of money must always be equal to a fixed amount of utility. The more convenient way is to make one unit of money equal to one unit of utility. The unit of money is different in different currencies. For example, in

USA the currency is dollars so the unit is dollar. It means one unit of utility is equal to one dollar. Indian currency is called rupee, so one unit of utility is equal to one rupee.

Note of caution : *It is to be remembered that modern economists do not hold to the view that marginal utility of money is constant. They are certain that law of diminishing marginal utility applies to money also.*

9. What is consumer's equilibrium ? How does the cardinal utility analysis describe the attainment of equilibrium by a consumer?

Ans. Equilibrium is a very important concept frequently used in economics. In general, equilibrium is defined as the state of balance between opposing forces so that there is no tendency to change. In the terminology of physics it may be described as the point of rest. More technically, equilibrium is a situation in which an economic agent (person, organization or institution which makes economic decisions) has no immediate reason to change its current economic behaviour or state of economic action, because given the aspirations and constraints the agent faces, it cannot improve its position in terms of any economic criteria by changing its current behaviour. From the angle of an economic variable, for example, price, wage etc, equilibrium means a situation in which the variable has no pressure to change from the current value.

Consumer's equilibrium is one of the many types of equilibrium as used in economics. It is defined as a situation in which, under given conditions, a consumer purchases such an amount of commodities that he derives highest level of utility or satisfaction, so that he has no reason either to increase or decrease the quantity of commodities he purchases. It may also be defined as a point of rest of a consumer with regard to his consumption or purchase of commodities.

In a single commodity case, that is, in case a consumer buys a single commodity, a consumer attains his equilibrium which also means that he obtains maximum level of satisfaction when marginal utility of the good he consumes equals the price he pays for obtaining the good. In other words, in single commodity case, the condition for consumer's equilibrium is

$$MUx = Px$$

Where MUx is the marginal utility of the good X and Px is the price of good X.

When a consumer pays price to obtain a good, two opposite forces are in operation. On the one hand, the consumer's total utility is increasing because of the positive marginal utility provided by the additional units of the commodity he is purchasing. On the other hand, his utility is decreasing because of the payment of money in the form of price to obtain the commodity. The difference between the two, that is, the utility derived from the consumption of the good and utility foregone because of the incurring of expenditure for obtaining the good may be called net utility. Symbolically;

$$\text{Net Utility (NU)} = TU_n - P_{x_n}$$

Where : TUn is the total utility from n units of the commodity (n is the number of units of the commodity purchased), and P_{x_n} is price of commodity x, (P_x) multiplied by number of units purchased (n). Hence (P_{x_n}) is the total expenditure incurred on the commodity.

It means, in this situation a consumer will be in equilibrium when his net utility, and not the total utility, is maximum.

MU_x denotes what consumer is willing to pay to obtain an additional unit of a good and P_x gives what he actually has to pay to obtain the additional unit of the good. Thus, the expression '$MU_x = P_x$' means that at this point what a consumer is willing to pay to obtain an additional unit of a good is equal to what he actually has to pay to obtain the additional unit of the good.

We can describe consumer's equilibrium diagrammatically as follows

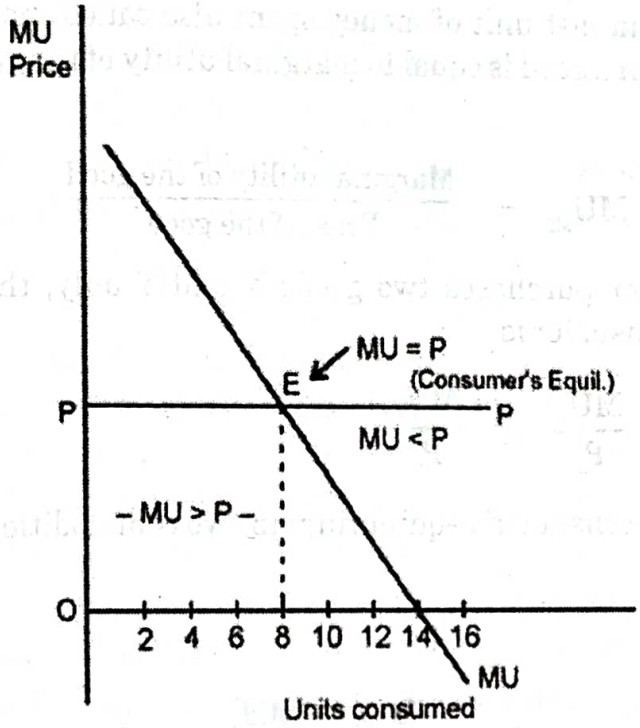

Fig. 5.4

In the figure, MU and Price are equal when consumer purchases Q units of the good. Before Qth unit what consumer wants to pay (MU) is greater than what he has to pay (price) so that his per unit gain is more than his per unit loss. It will be beneficial for him to purchase some more units. This will increase his net utility. At Qth unit, he pays what he is willing to pay, so that his gain is equal to his loss. After Qth unit, what he wants to pay is less than what he has to pay, so that his loss is greater than his gain; it will be better for him if he restricts his consumption to Q units. Thus it is at Qth unit that the net utility of the consumer is at its maximum and he has no reason to change his action; if he consumes less than Q units his net utility will not be maximum and if he consumes more than Q units, his net utility will again be less than its maximum. Thus, the consumption of Qth unit at which 'MU = P' is his point of rest or his (consumer's) point of equilibrium.

However, no consumer purchases a single commodity: everybody consumes more than one good. In this situation consumer's equilibrium is governed by law of equi-marginal utility, and not the law of diminishing marginal utility as is the case when the consumer purchases a single commodity.

The law of equi-marginal utility states that to maximise utility, consumers allocate spending among goods in such a way so that equal utility is derived from the last unit of money spent on each good. It simply means that to maximise utility a consumer will purchase

such quantities of various goods which equalise the marginal utility derived from the unit of the money spent on each good.

To put it differently, law of equi-marginal utility states that a consumer will b equilibrium when the utility derived from spending an additional unit of money is same for all commodities.

This general principle is also called optimal consumption rule because when condition is satisfied the consumer gets highest possible (optimal) level of satisfaction fr his consumption.

Utility derived from last unit of money spent also called marginal utility of mo expenditure (MUME) on a good is equal to marginal utility of the good divided by the pr of the good. That is

$$MU_{ME} = \frac{\text{Marginal utility of the good}}{\text{Price of the good}}$$

In case, a consumer purchases two goods X and Y only, the condition for util maximisation by the consumer is

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

Diagrammatically, consumer's equilibrium in two commodities case can be shown follows :

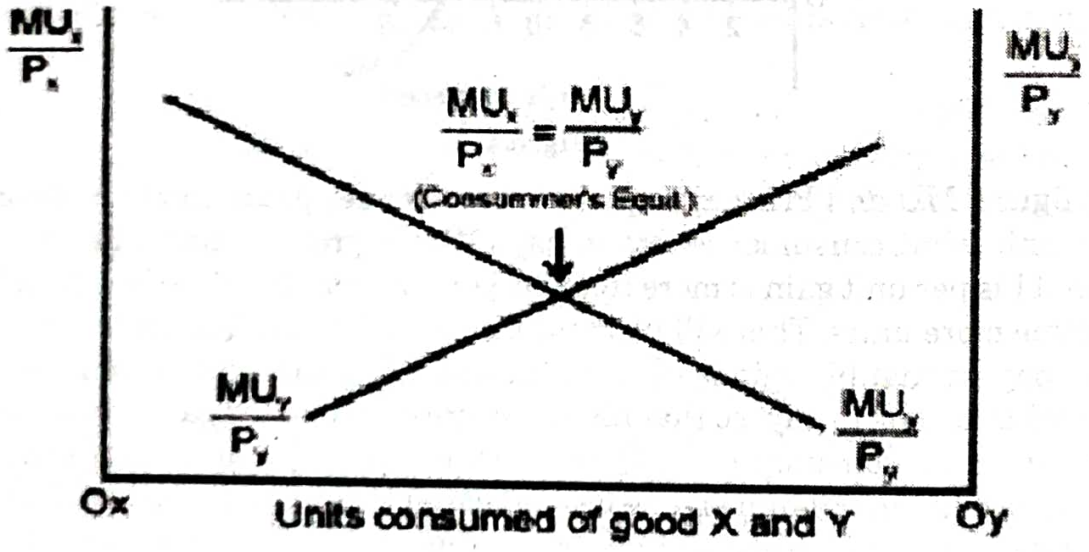

Fig. 5.5

Horizontal axis measures goods X and Y. Good X is measured from O_x to O_y and go Y is measured from O_y to O_x. When we move from O_x to O_y, quantity purchased of good increases and that of good Y decreases. When we move from O_y to O_x, quantity purchas of good Y increases and good X decreases.

Left axis of the diagram measures MU_x/P_x and right axis measures MU_y/P_y. Downwa slopping MU_x/P_x and MU_y/P_y curves show that the marginal utility derived from last rup spent on each good goes on falling as more of the good is purchased.

The two curves intersect at point E. This intersection between the two curves means the equality between MU_x/P_x and MU_y/P_y, that is, at point E $MU_x/P_x = MU_y/P_y$, which is the condition for consumer's equilibrium in case he purchases two goods, X and Y.

If the MU_x/P_x is greater than MU_y/P_y, it means the utility derived from last rupee spent on X is greater than the utility derived from last rupee spent on Y, it is better for the consumer to purchase more of X and less of Y. This will increase his net utility. But when he purchases more of X and less of Y, marginal utility of X will decrease and that of Y will increase. Given constant P_x and P_y, this will result in a decrease in MU_x/P_x and an increase in MU_y/P_y. The consumer will continue substituting X for Y, that is, he will continue to purchase more of X and less of Y till MU_x/P_x equals MU_y/P_y. When the two will become equal, there will be no reason for the consumer to shift a rupee of spending from one product to another because this will only decrease his utility from its maximum.

Equality of marginal utility of money expenditure on different goods or what is same thing, the equality of ratios of marginal utility to the price of different goods is only one of the two conditions necessary for the attainment of equilibrium by a consumer. This equality can occur at more than one place: the equality can occur at a point at which the consumer has not spent all his income. It can also occur at a point at which required expenditure may exceed the income of the consumer. Only the point at which the consumer spends all his income does the equality of ratios of marginal utility to the price of different goods describe a consumer's equilibrium. Thus, there are two conditions for attainment of equilibrium by a consumer in case he purchases more than one good. These are

1. Ratios of marginal utility to the price of different goods is equal
2. The budget constraint is satisfied or the consumer spends all his income

10. Critically evaluate the cardinal utility approach to the study of consumer behaviour.

Ans. Cardinal utility analysis suffers from some serious shortcomings, drawbacks and limitations. Some of these include:

(*i*) Cardinal utility analysis, as the name suggests, assumes that utility can be measured in cardinal numbers or quantitative terms. But utility is a psychic and subjective thing and it cannot be measured in cardinal numbers. Hence the assumption of cardinal measurement of utility is an unrealistic assumption.

(*ii*) Cardinal utility analysis also assumes that utilities derived from various goods are independent. This means that the consumption of one good has no effect on the utility derived from other goods. However, in actual life the consumption of one good may have some effect on the utility derived from the consumption of others. The cases of complements and substitutes are apt to cite which explicitly indicate that utility derived from one good is surely affected by the consumption of other goods. Hence, the assumption of independence of utilities is also an unrealistic one.

(*iii*) Similarly, the assumption of constant marginal utility of money which states that when a consumer spends varying amounts of money on a good or various goods or when the price of a good changes, marginal utility of money remains unchanged, is also not valid. With the decline in money income of a consumer as a result of increase in his expenditure on goods, the marginal utility of money to him surely rises. In short, law of diminishing marginal utility applies to money also but was ignored by cardinal utility theorists.

(*iv*) Because of the assumption of constant marginal utility of money, cardinal utility analysis could not differentiate between income effect and substitution effect of a price change, and as a result could not explain the Giffen Paradox.

CHAPTER 6

Indifference Curve Analysi

1. What is consumer choice?

Ans. It is a known economic fact that both individuals and society face the econom problem: they need to make choices because economic wants are unlimited, but the mea (income, time, resources) for satisfying those wants are limited. For a rational individual firm, the first step in the economic analysis of any choice is to identify what is possible-wh economists call the opportunity set, which is simply the group of available options, a choice involves the selection of the best possible option.

Because individuals or consumers aim at satisfying wants or maximising utility, a because want satisfaction requires the consumption of goods and services, it means consum choice involves the selection of that basket of goods which gives a consumer the highe level of satisfaction.

Choice is limited by constraints. Constraints are the factors which limit the opportuni set or the set of available options of an economic agent.

In most economic situations, the constraints that limit a person's choices are time a money. The constraints imposed by time factor are called time constraints and the constrain imposed by money are called budget constraints.

2. What is ordinal utility analysis? What are its assumptions?

Ans. Cardinal utility analysis had a major drawback. It was that cardinal utility analys considered utility to be a measurable phenomenon. Utility is a psychic or subjective entit and cannot therefore be measured in cardinal terms. It is unrealistic to assume that consumer is capable of comparing level of satisfaction obtained from the consumption different goods: a consumer can never say how much utility he obtained from t consumption of a good.

However, it is possible that a consumer can judge whether the satisfaction obtain from a good or a combination of goods is equal to, lower than or higher than, another. other words, a consumer is capable of ordering or ranking the goods in order of t satisfaction obtained from their consumption.

When a consumer cannot say by how much utility differs between the first and t second good and, say, the second and third good, but can rank goods in accordance wi the level of satisfaction provided, he is using ordinal numbers. Ordinal numbers are tho numbers which are used to describe the position of things or to rank the alternative Examples of ordinal numbers are first, second, third etc.

The utility analysis which abandoned cardinal measurement of utility because of its unrealistic nature, and adopted the ordinal measurement of utility which seems more realistic is called ordinal utility analysis. In short, ordinal utility analysis asserts that in comparing utility levels, the direction of differences can be observed but the magnitude of differences cannot be measured.

While using ordinal utility analysis, following assumptions are made about the nature of consumers' preferences.

1. **Consumer rationality :** Consumer rationality means that a consumer's objective is to maximise his utility or to get highest level of satisfaction. In order to maximise his utility, a consumer will chose that commodity combination from the available options which gives him the highest level of satisfaction, given the constraints he faces.
2. **Ordinal measurement of utility :** This assumption asserts that in comparing utility levels, the direction of differences can be observed but the magnitude of differences cannot be measured.
3. **Complete Ordering :** This assumption says that a consumer is capable of ordering or ranking all available alternative combinations of commodities in order of satisfaction they provide him.
4. **Transitivity of preference ranking :** This assumption says that if a person prefers a commodity A to a commodity B, and also prefers commodity B to commodity C, then he must prefer commodity A to commodity C.
5. **Non-satiation of wants :** This assumption says that a consumer always prefers more of a commodity to less of it

3. What is an indifference curve? What is an indifference curve map?

Ans. An indifference curve is a diagram representing preferences of an individual. More specifically, an indifference curve is a line that shows all the combinations of two goods that yield the same amount of total utility for an individual. In other words, an indifference curve is the line giving the combinations of goods among which an individual has no preference (that is, is indifferent) or which yield the same level of utility to the consumer. The line is called indifference curve for the reason that it gives combinations of two goods among which a consumer is indifferent as every combination gives him the same level of utility.

There is every possibility that a person can be indifferent between two bundles or collections of goods. Suppose that collection A consists of 2 pairs of shoes and 6 shirts and that collection B consists of 3 pairs of shoes and 4 shirts. A person who is indifferent between these two collections is implicitly saying that one is as good as the other. He is likely to say this, though, only if he receives equal total utility from the two collections. If not, he would prefer one collection to the other.

If we tabulate all the different collections from which the individual receives equal utility, we have an indifference set.

Consider the indifference set in the following table.

Collection	*Bananas*	*Mangoes*
A	2	7
B	3	4
C	4	6
D	6	2

Of the four collections of bananas and mangoes, A to D, each collection gives the sam total utility as every other one. The information about the actual amount of utility obtaine is not necessary. It is sufficient that the consumer is aware that he obtains equal level o utility from these four collections.

By plotting these equal-utility collections in a commodity space and connecting th points so plotted gives us an indifference curve; a curve that shows alternative combination of two goods that give the consumer the same level of satisfaction.

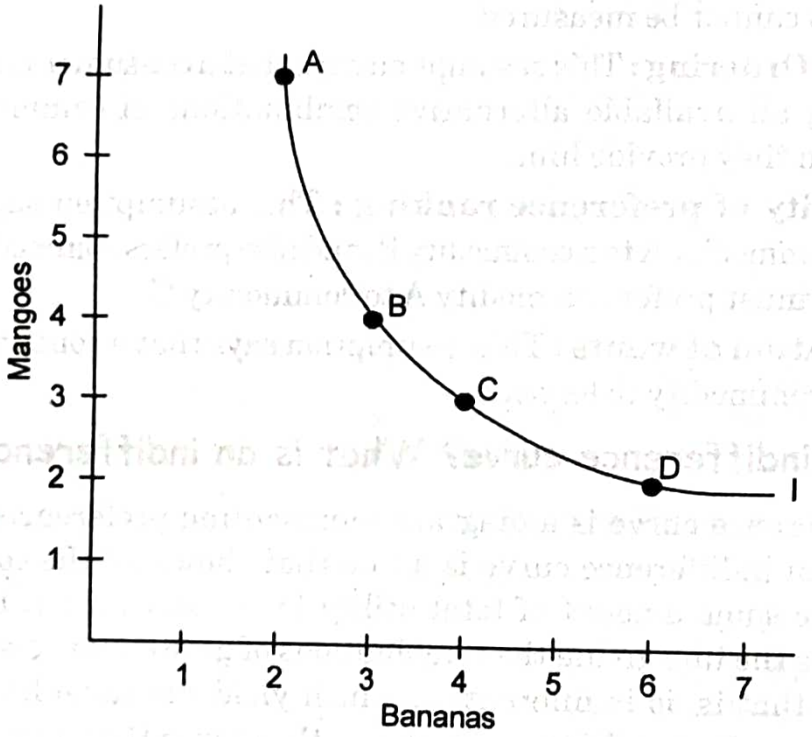

Fig. 6.1

Horizontal axis of the diagram shows consumption of bananas and vertical axis shows consumption of mangoes. The curve labelled as I is an indifference curve giving various combinations of bananas and mangoes which give same level of utility to some hypothetical consumer.

Indifference Curve Map

There exist different collections of the two goods which have different indifference curves passing through them. These collections may have less of at least one good, or more of at least one good, than others. Illustrating a number of indifference curves on the same diagram gives us an indifference curve map, which represents a number of indifference curves for a given individual with reference to two goods gives an indifference curve map.

In other words, an indifference curve map is a collection of indifference curves that represents a given consumer's entire preference with reference to two goods, with each indifference curve corresponding to a different level of total utility,

Following diagram shows three indifference curves—l_1, l_2 and l_3—from a consumer's indifference curve map, as well as several consumption bundles, A, B, C, and D.

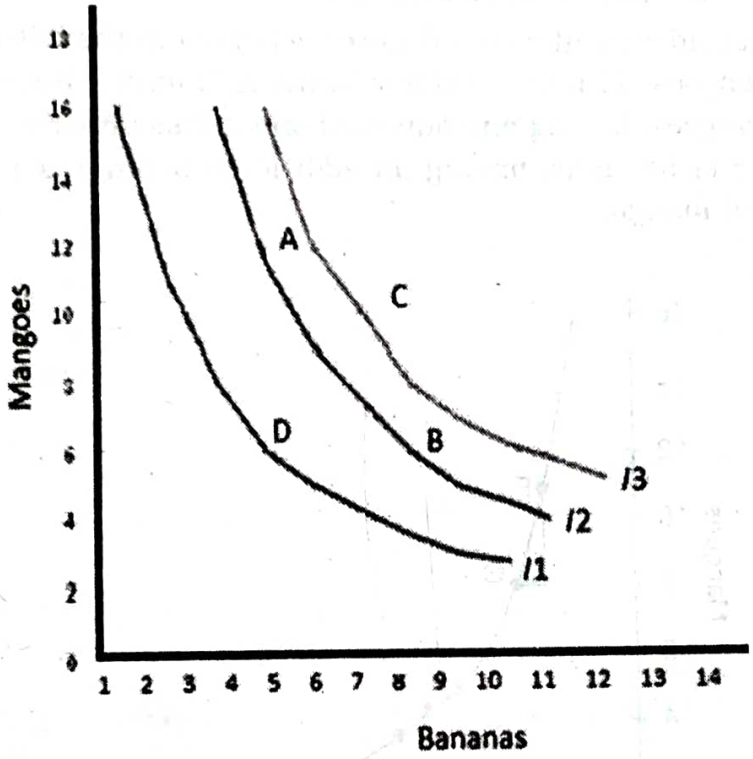

Fig. 6.2

Combination	*Bananas*	*Mangoes*	*Total Utility*
A	6	12	U_1
B	9	6	U_1
C	8	10	U_2
D	5	6	U_0

The accompanying table lists various combinations, their composition of bananas and mangoes, and the total utility it yields, where U_0 is less than U_1 and U_1 is less than U_2. Because collections A and B generate the same level of utility, U_1, they lie on the same indifference curve, l_2. Although the consumer is indifferent between A and B, he is certainly not indifferent between A and D: as one can see from the table, D generates only U_0 level of utility, a lower total utility than A or B. So the consumer prefers commodity collections A and B to collection D. This is represented by the fact that D is on indifference curve l_1, and l_1 lies below l_2. Collection C, though, generates U_2 level of utility, a higher total utility than A and B. It is on l_3, an indifference curve that lies above l_2. Clearly, the consumer prefers C to either A or B. And, even more strongly, he prefers C to D

Although only three indifference curves have been drawn, many more could have been added. For example, many indifference curves lie between l_1 and l_2.

4. Explain the principle of diminishing marginal rate of substitution?

Ans. If an individual wants to have an additional unit of one good, he has to give up some quantity of other good if the utility is to remain same. How much of one good an individual is *willing* to give up in return for one more unit of another? This depends on how much of an item an individual already has.

For example, consider point F on indifference curve *l* in the following diagram where Kabir has many mangoes (11 units) and few bananas (3 units). Because he already has a large number of mangoes, having an additional one is less important. However, because he has less number of bananas, having an additional banana is more important than having an additional mango.

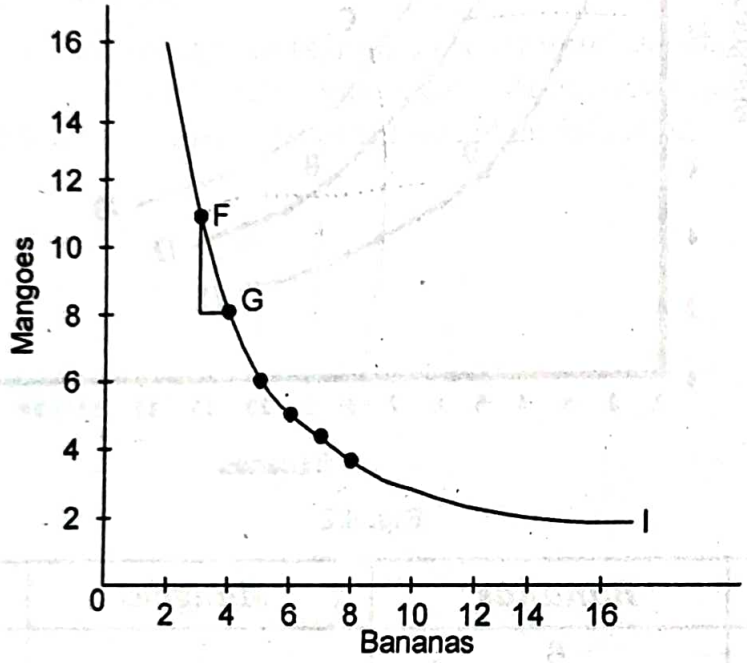

Fig. 6.3

If Kabir wants to have an additional banana, does he need to give up an additional mango and still enjoy the same utility as at point F. The answer is no, and the reason being that at F one banana is more important than one mango. In utility terms it means that at this point the marginal or last banana gives Kabir more utility than the marginal mango. If Kabir gives up one mango and receives one additional banana, his gain in utility is more than his loss so that he is not enjoying the same level of utility as at F. Rather his utility is more than at F.

It means at F Kabir has to give up more than one mango for an additional banana if his total utility has to remain same as at F. Let us suppose that Kabir has to give up 3 mangoes for an additional banana in order to enjoy same total utility as at F.

The amount of one good, say Y, an individual is willing to give up to obtain an additional unit of another good, say X, and maintain equal total utility is called marginal rate of substitution of X for Y denoted by $MRS_{X,Y}$. In other words, the marginal rate of substitution of X for Y ($MRS_{X,Y}$) tells us how many units of Y a consumer is willing to give up for an extra unit of X without causing any change in total utility enjoyed. Mathematically it is

given by $\frac{\Delta Y}{\Delta X}$—the amount of Y given by ΔY an individual is willing to give up to obtain some given amount of X given by ΔX, without causing any change in utility enjoyed.

In our example, at point F marginal rate of substitution is $\frac{3}{1} = 3 : 1$ or three mangoes for one banana.

At a different point than F, marginal rate of substitution will be different. In principle marginal rate of substitution for a good diminishes as an individual has more of it. For example, at point G, Kabir has more bananas and fewer mangos than at F. Hence, he will not be willing to give up 5 mangoes for an additional banana. At this point he would give up less than 5 mangoes for an additional banana so as to maintain equal total utility. Let us say that at point G, marginal rate of substitution is 2, that is, 2 mangoes for one banana which is less than 3 mangoes for one banana at point F.

In short, the principle of diminishing marginal rate of substitution says that the amount of one good an individual is willing to give up to obtain an additional unit of another good without causing any change in total utility enjoyed decreases as the individual obtains more of the second good.

The principle of diminishing marginal rate of substitution can be explained in more detail with a table and a diagram as follows:

Combinations	*Units of Bananas*	*Units of Mangoes*	*MRS of B for M = ΔM/ΔB*
A	1	12	–
B	2	8	4
C	3	5	3
D	4	3	2
E	5	2	1

The table shows that in order to obtain a given level of utility (not shown in the table) a hypothetical consumer can purchase any of the five combinations of bananas and mangoes- A to E. Starting from combination A, the consumer can purchase 1 unit of bananas with 12 units of mangoes. It can also consume 2 units of bananas with 8 units of mangoes, and so forth.

The thing to be noted is that in the beginning the consumer is consuming a larger quantity of mangoes relative to bananas. In this case marginal utility of bananas must be very large than that of mangoes. If the consumer wants to increase the quantity of bananas, he has to decrease the quantity used of mangoes if the level of utility is to remain fixed. At this point the consumer has to give up 4 units of mangoes in order to consume an extra unit of bananas so that utility remains constant. It means at this time marginal rate of substitution of bananas for mangoes or MRSB, M given by $f'M/f'B$ equals 4 : (4/1 = 4). The consumer is consuming combination B : 2 units of bananas and 8 units of mangoes.

If the consumer wants to consume another unit of bananas, he has to give up some more units of mangoes if the level of utility is to remain constant. At this point, compared to

point A, marginal utility of bananas will have decreased and that of mangoes will have increased. The reason being that compared to combination A, the consumer is consuming more bananas (2 compared to 1) and fewer mangos (8 compared to 12). As a result, the consumer needs not to give up 4 units of mangoes for 1 unit of bananas. Rather he has to give up only 3 units of mangoes for 1 unit of bananas. It means at this point $MRS_{B,M}$ ($\Delta M/\Delta B$) equals 3 : (3/1 = 3). The consumer is consuming combination C : 3 units of bananas and 5 units of mangoes.

Repeating the exercise we can see that as the consumer increases the quantity of bananas, he has to give up lesser and lesser quantity of mangoes to maintain the given level of utility which means MRS of bananas for mangoes goes on decreasing because increase in quantity of bananas decreases its marginal utility and decrease in quantity of mangoes increases it marginal utility. At D MRSB, M is 2 and at E it is 1.

Same thing can be explained diagrammatically as follows.

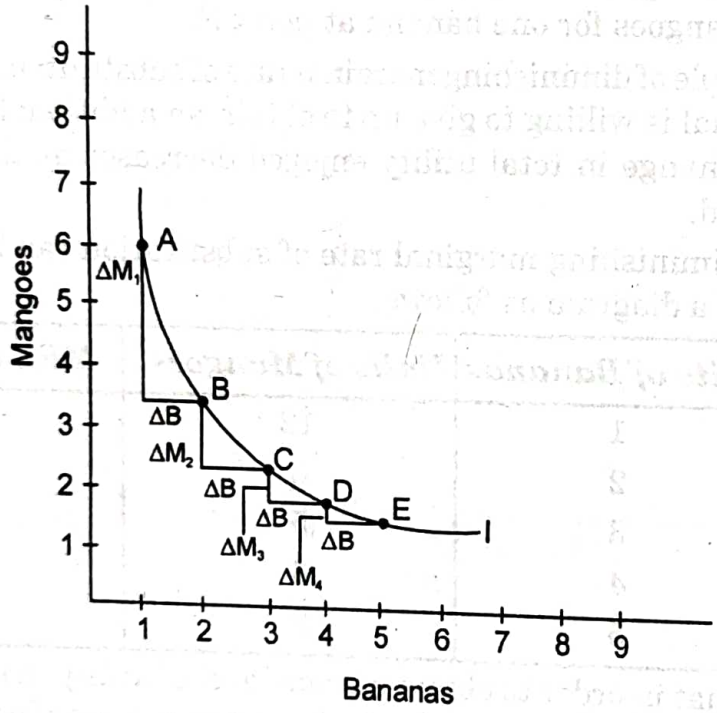

Fig. 6.4

Horizontal axis of the diagram shows consumption of bananas and vertical axis shows consumption of mangoes. The curve labelled as I is an indifference curve giving various combinations of bananas and mangoes which give same level of utility to some hypothetical consumer.

We start from point A. When the consumer moves from point A to point B on the given indifference curve, he gives up ΔM_1 of mangoes for ΔB of bananas. Therefore, the $MRS_{B,M}$ is $\Delta M_1/\Delta B$. As the consumer slides down along the indifference curve, keeping the length of ΔB fixed, the length of ΔM becomes shorter and shorter. It can be seen from the figure that ΔM_1 is longer than ΔM_2. ΔM_2 is longer than ΔM_3 and so on. It means as quantity of bananas increases and that of mangoes decreases, the consumer has to give up less and less of mangoes for a given increase in mangoes. In other words, the marginal rate of substitution of bananas for mangoes diminishes as the stock of bananas increases and that of mangoes decreases.

5. Show that the marginal rate of substitution between two goods equals the slope of an indifference curve.

Ans. The fact that the marginal rate of substitution between two goods equals the slope of an indifference curve can be shown with the help of the following diagram:

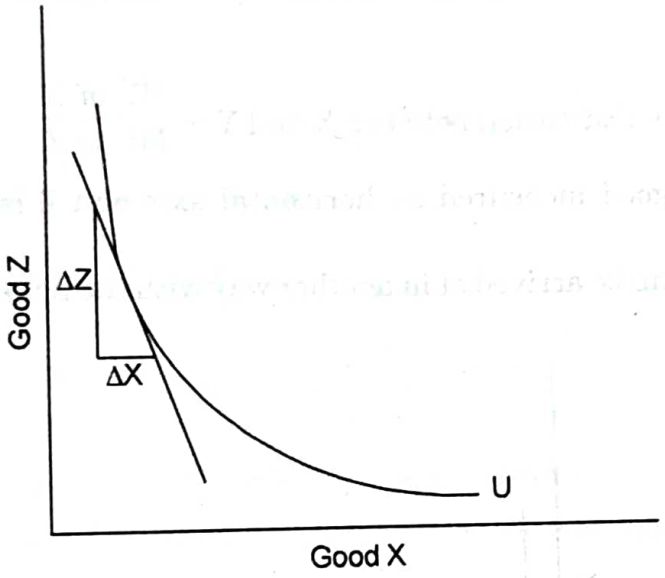

Fig. 6.5

The diagram gives an indifference curve U which shows the consumption of two goods, X and Z, by a particular consumer. When the consumer moves from any given bundle, such as bundle A, to an equally preferred bundle farther to the right on the curve, such as bundle B, he must give up some of one good (Z) to get more of the other good (X).

The slope of the indifference curve at any point (*i.e.*, the slope of the line tangent to the curve at that point) is $\Delta Z/\Delta X$ -the rate of change of Z relative to the change of X.

But the expression $\Delta Z/\Delta X$ is actually a measure of the consumer's marginal rate of substitution between the two goods, X and Z-the amount of Z he would give up (ΔZ) to gain additional X (ΔX) withour causing an change in total utility enjoyed.

In short, the slope of an indifference curve at any point given by the slope of the line tangent to the curve at that point gives the marginal rate of substitution between the two goods represented by the indifference curve.

However, because an indifference curve slopes downwards from left to right, the slope of an indifference curve is negative. It means, on a graph with X on the horizontal axis and Z on the vertical axis, $MRS_{x,z}$ at any point is the *negative* of the slope of the indifference curve at that point.

6. Give the relationship between marginal rate of substitution and marginal utility.

Ans. The marginal utility of any good is the increase in utility that the consumer gets from an additional unit of that good. Most goods are assumed to exhibit diminishing marginal utility: the more of the good the consumer already has, the lower the utility provided by an extra unit of that good.

The marginal rate of substitution between two goods depends on their marginal utilities. For example, if the marginal utility of good X is twice the marginal utility of good Z, then a person would need 2 units of good Z to compensate for losing 1 unit of good X, and the marginal rate of substitution equals 2. More generally, the marginal rate of substitution equals the marginal utility of one good divided by the marginal utility of the other good. That is,

$$\text{Marginal rate of substitution between X and Y} = \frac{\text{MU of X}}{\text{MU of Z}}$$

Where X is the good measured on horizontal axis and Z is the good measured on vertical axis.

The same result can be arrived at in another way with the help of the following diagram as follows:

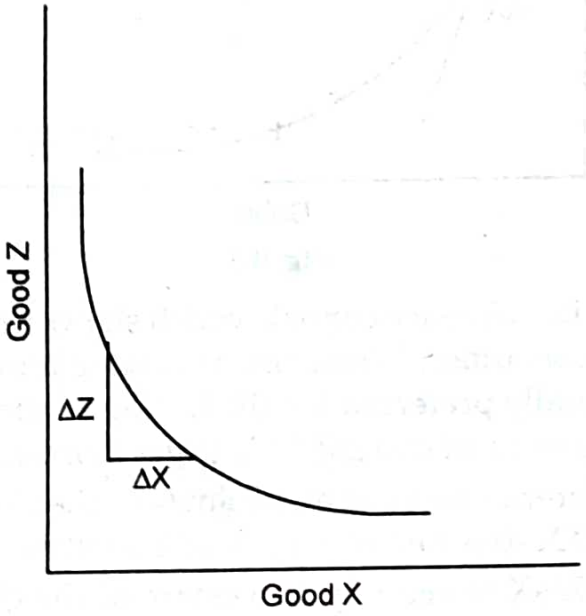

Fig. 6.6

The diagram gives an indifference curve U which shows the consumption of two goods, X and Z, by a particular consumer. Suppose the consumer changes the level of consumption of X and Z by ΔX and ΔZ, respectively. The corresponding impact on utility ΔU will be equal to change in X multiplied by marginal utility of X plus change in Z multiplied by marginal utility of Z. That is,

$$\Delta U = MUx(\Delta X) + MUz(\Delta Z)$$

But it must be that ΔU = 0, because changes in X and Z that move the consumer along the indifference curve U must keep utility unchanged. So

$$0 = MUx(\Delta X) + MUz(\Delta Z)$$

This can be rewritten as

$$MUz(DZ) = -MUx(\Delta X)$$

Or

$$-\frac{MUx}{MUz} = \frac{\Delta Z}{\Delta X}$$

$$\frac{MUx}{MUz} = -\frac{\Delta Z}{\Delta X}$$

Or

This means the (negative) slope of an indifference curve of two goods X and Z, $(-\frac{\Delta Z}{\Delta X})$ equals the ratio of the marginal utilities of the two goods $\left(\frac{MUx}{MUz}\right)$.

Finally, since marginal rate of substitution between X and Z (MRSx, z) is the negative of the slope of the indifference curve, that is,

$$-\frac{\Delta Z}{\Delta X} = MRSx, z$$

We observe that $-\frac{\Delta Z}{\Delta X} = MRSx, z = \frac{MUx}{MUz}$

7. Describe the properties of indifference curves.

Ans. Indifference curves exhibit some unique properties. Some of these properties include:

1. **Indifference curves are downward sloping (from left to right).** The assumption that consumers always prefer more of a good to less requires that indifference curves slope downward from left to right. Consider the alternatives to downward sloping indifference curve: vertical, horizontal, and upward sloping from (left to right). A horizontal or vertical curve would combine collections of goods, some of which had more of one good and no less of another good than other collections.

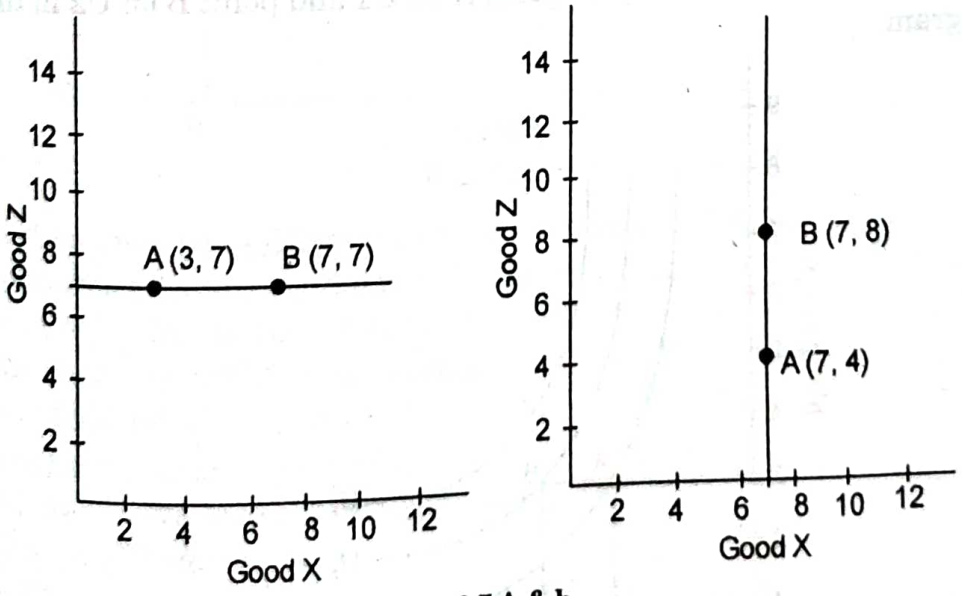

Fig. 6.7 A & b

If collection B contains more of one good and no less of another good than collection A, an individual would not be indifferent between them because individuals prefer more to less.

An upward-sloping curve would combine collections of goods, some of which had more of both goods than other collections.

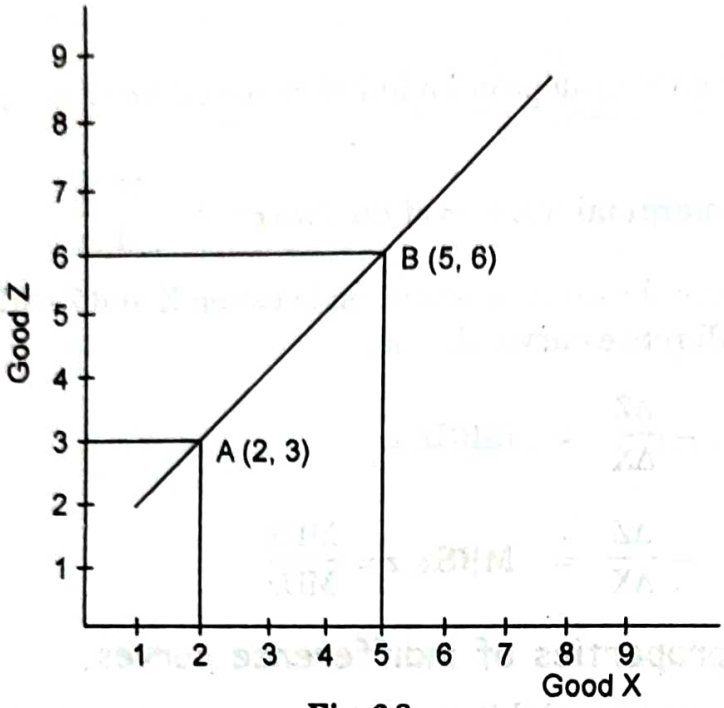

Fig. 6.8

Point B has more of both goods than point A so the combinations represented by two points cannot provide same level of utility.

More simply, indifference curves are downward sloping because a person has to give up some quantity of one good in order to maintain a given level of satisfaction (utility) when obtaining more of another good.

2. **Indifference curves that are farther from the origin are preferable.** The farther away from the origin an indifference curve lies, the higher the total utility is that it represents. Compare point A on U1 and point B on U2 in the following diagram.

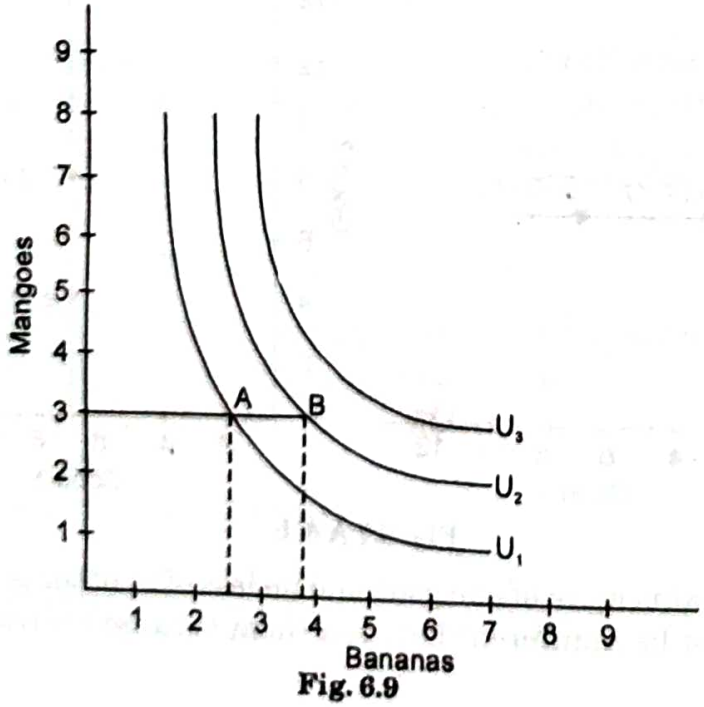

Fig. 6.9

At point B, there is the same quantity of mangoes as at point A but more bananas. Point B is therefore preferable to point A, and, because B is on U_2 and A is on U_1, U_2 is preferable to U_1. The reason is simple: An individual receives more utility at any point on U_2 (because more goods are available) than at any point on U_1.

3. **Indifference curves do not cross (intersect).** Indifference curves do not cross because individual's preferences exhibit transitivity, the principle whereby if A is preferred to B, and B is preferred to C, then A is preferred to C. For example, if Kabir prefers Coca-Cola to Pepsi-Cola and he also prefers Pepsi-Cola to Due, then he must prefer Coca-Cola to Due. If he said he preferred Due to Coca-Cola, he would be contradicting his earlier preferences. To say that an individual has transitive preferences means that he maintains a logical order of preferences over a given time period.

Given the assumption of transitivity of preferences, consider what intersecting indifference curves would represent. In the following diagram, indifference curves U_1 and U_2 intersect at point A, which lies on both U_1 and U_2.

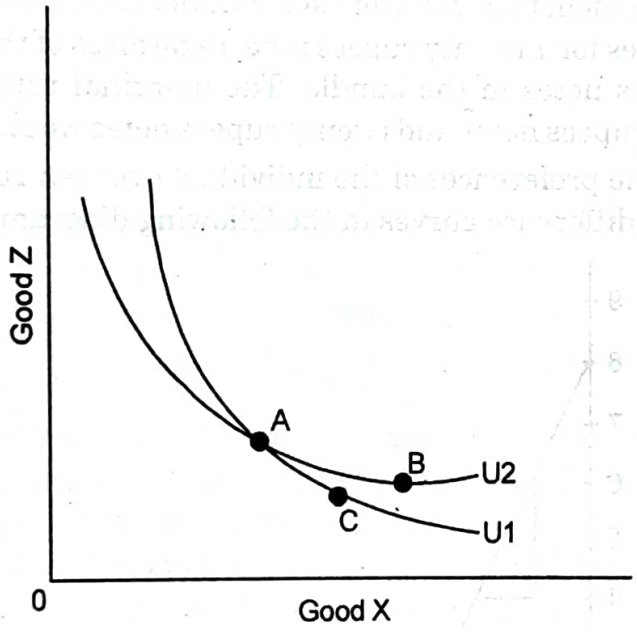

Fig. 6.10

An individual must be indifferent between combinations A and B because they lie on the same indifference curve; U_2. Same holds for combinations A and C; they lie on the indifference curve U_1. But if the individual is indifferent between A and B and between A and C, then he must be indifferent between B and C. But B has more of both goods than C, and thus the individual will not be indifferent between B and C; he will prefer B to C.

We cannot have transitive preferences and make sense of crossing indifference curves. We can, however, have transitive preferences and make sense of non-crossing or nonintersecting indifference curves.

4. **Indifference curves are bowed inward (convex to the origin).** The principle of diminishing marginal rate of substitution which says that the amount of one good an individual is willing to give up to obtain an additional unit of another good, and maintain equal total utility, decreases as the individual obtains more of

the second good, has an important implication for the shape of an indifference curve: as we move down and to the right along an indifference curve, it becomes flatter. In other words, an indifference curve is convex to the origin. If an indifference curve is concave to the origin, it will imply that marginal rate of substitution of a good increases as more of it is obtained.

8. Write a note on L-shaped and straight indifference curves.

Ans. An indifference curve is a graphic exhibition of the preferences of a consumer. Generally, indifference curves are convex to the origin indicating the principle of diminishing marginal rate of substitution. Marginal rate of substitution, in turn, is a reflection of the substitutability between two goods. When the goods are easy to substitute for each other, the indifference curves are less bowed; when the goods are hard to substitute, the indifference curves are very bowed.

Suppose that someone is offered bundles of rupees ten notes and rupees twenty notes. How would the individual rank the different bundles? Most likely, the individual would care only about the total monetary value of each bundle. If so, he would always be willing to trade 2 ten rupees notes for 1 twenty rupees note, regardless of the number of ten rupees notes and twenty rupees notes in the bundle. The marginal rate of substitution of the individual between ten rupees notes and twenty rupees notes would be a fixed number—2.

We can represent the preferences of the individual over ten rupees notes and twenty rupees notes with the indifference curves in the following diagram.

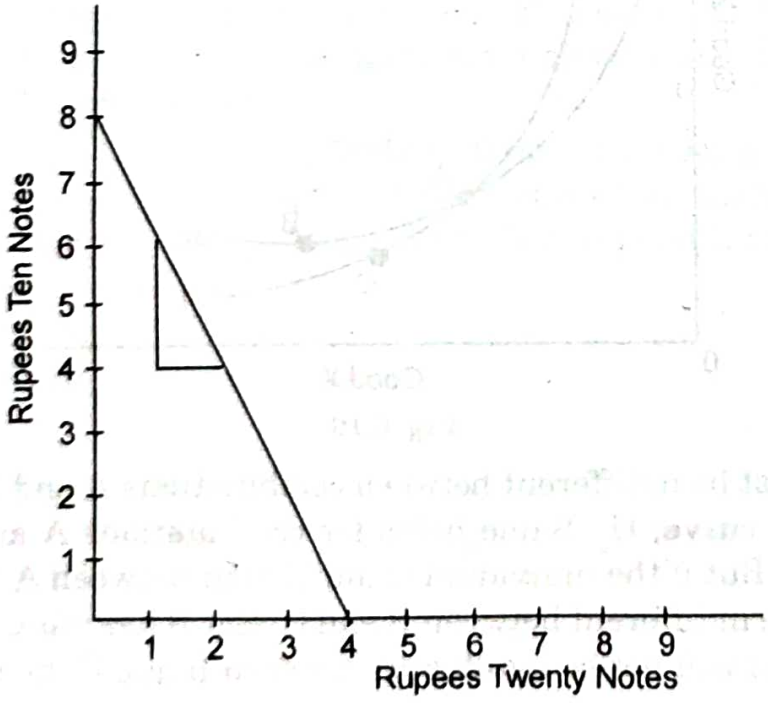

Fig. 6.11

Because the marginal rate of substitution is constant, the indifference curves are straight lines. In this extreme case of straight indifference curves, we say that the two goods are perfect substitutes.

Thus, two goods are perfect substitutes when a consumer is completely indifferent between them or when the consumer can substitute them at a constant rate.

Suppose now that someone is offered bundles of socks. Some of the socks fit his left foot, others his right foot. How would he rank these different bundles? In this case, he might care only about the number of pairs of socks. In other words, he would judge a bundle based on the number of pairs he could assemble from it. A bundle of 3 left socks and 4 right socks yields only 3 pairs. Getting 1 more right sock has no value if there is no left sock to go with it. We can represent preferences of this individual for right and left socks with the indifference curves as in the following diagram.

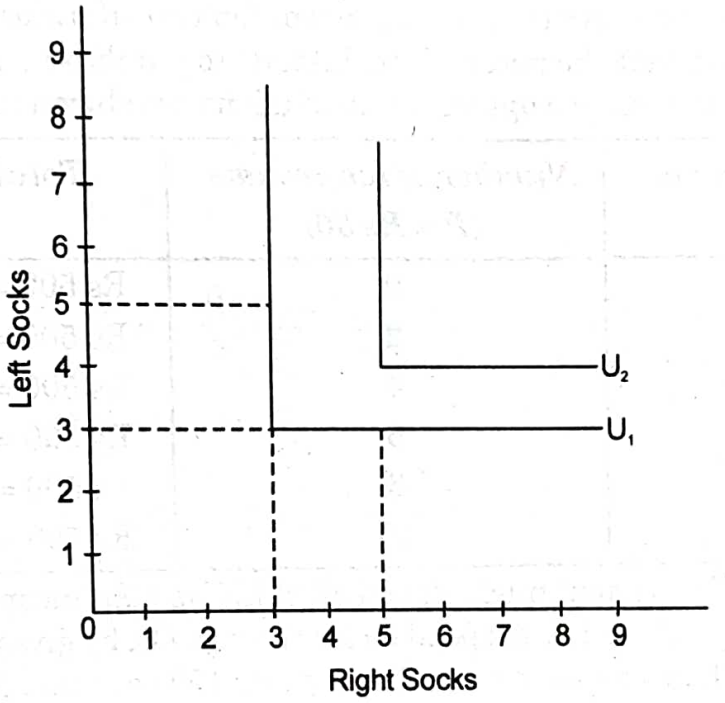

Fig. 6.12

In this case, a bundle with 3 left socks and 3 right socks is just as good as a bundle with 3 left socks and 5 right socks. It is also just as good as a bundle with 5 left socks and 3 right socks. The indifference curves, therefore, are right angles or L-shaped. In this extreme case of right-angle indifference curves, we say that the two goods are perfect complements.

Thus, two goods are perfect complements when a consumer is interested in consuming them in fixed proportions.

In the real world, of course, most goods are neither perfect substitutes (like ten rupees notes and twenty rupees notes) nor perfect complements (like right socks and left socks). More typically, the indifference curves are bowed inward, but not so bowed as to become right angles.

9. What is a budget constraint? What is its relation with budget line?

Ans. In economics, constraints are the factors which limit the set of available options of an economic agent, say a consumer. The constraints which are imposed by money are called budget constraints. Budget constraint says that the value of expenditure cannot exceed the value of income. Because expenditure (E) equals the quantity purchased (Q) times the price (P), or $E = Q \times P$, price is the other determinant of budget constraint- other than the price.

For example, if a person has an income of Rs 10,000, and he intends to buy a mobile, his opportunity set is the mobiles whose prices are below Rs 10,000. Mobiles which cost more than Rs 10,000 are not in his opportunity set.

In a two commodity case, a budget constraint indicates the various combinations of two products a consumer can purchase with a specific money income.

To understand this idea, suppose a student receives Rs 500 as birthday present. This is the income of this student. The student can spend this money income as he likes. Suppose further that the student decides to spend his income on two alternatives: notebooks and ice creams. Let us suppose that the notebook he intends to purchase costs Rs 100 and the ice cream costs Rs 50. The purchase options of the student are shown in the following table:

Number of Notebooks (P = Rs 100)	***Number of Ice creams (P = Rs 50)***	***Total Expenditure***
5	0	Rs 500 = Rs 500 + Rs 0
4	2	Rs 500 = Rs 400 + Rs 100
3	4	Rs 500 = Rs 300 + Rs 200
2	6	Rs 500 = Rs 200 + Rs 300
1	8	Rs 500 = Rs 100 + Rs 400
0	10	Rs 500 = Rs 0 + Rs 500

At one extreme, the student might spend all of his Rs 500 "income" on 5 notebooks at Rs 100 each and have nothing left to spend on ice creams. Or, by giving up 1 note book and thereby saving Rs 100, he can have 4 notebooks at Rs 100 each and 2 ice creams at Rs 50 each. And so on to the other extreme, at which he could buy 10 ice creams at Rs 50 each, spending his entire income on ice creams with nothing left to spend on notebooks.

A graph which shows the combinations of quantities of two goods a consumer can buy by spending all his given income, given the prices of two goods is called budget line. (Budget line is also known as income line, consumer possibility line, price line, wealth line, and even budget constraint),

In equation form the budget constraint is written as:

$$Y = P_xX + P_zZ$$

Where Y is income of consumer

Px is price of good X

X is quantity purchased of good X

Px X is expenditure on good X

Pz is price of good Z

Z is quantity purchased of good Z

Pz Z is expenditure on good Z

The equation says that the total expenditure given by expenditure on good X (Px X) plus expenditure on good Z (Pz Z) equals total income (Y) of consumer.

Rearranging the equation giving budget constraint, we have

$$Z = \frac{Y}{P_z} - \frac{P_x}{P_z} X$$

And $$X = \frac{Y}{P_x} - \frac{P_z}{P_x} Z$$

These two expressions give the quantities of goods X and Y respectively, given the income, prices of goods, and the quantity purchased of other good.

Suppose the student decides to purchase ice creams (good X) only. It means he purchases zero units of notebooks (good Z). Putting the values in the expression

$$X = \frac{Y}{P_x} \cdot \frac{P_z}{P_x} Z$$

We have $$X = \frac{\text{Rs } 500}{\text{Rs. } 50} - \frac{\text{Rs } 100}{\text{Rs. } 50} \times 0$$

$$X = 10 - 0$$

$$X = 10$$

It means if the student decides to purchase ice creams only, and given the prices and income, he can buy 10 ice creams.

Now suppose the student decides to purchase notebooks (good Z) only. It means he purchases zero units of ice creams (good X). Putting the values in the expression

$$Z = \frac{Y}{P_z} - \frac{P_x}{P_z} X$$

We have $$Z = \frac{\text{Rs } 500}{\text{Rs } 100} \cdot \frac{\text{Rs } 50}{\text{Rs } 100}$$

$$Z = 5 - 0$$

$$Z = 5$$

It means if the student decides to purchase notebooks only, and given the prices and income, he can buy 5 notebooks.

If we plot the above information in a commodity space, that is, on a graph whose axis measure quantities of commodities, we will get the following Fig. 6.13.

Horizontal axis measures good X and vertical axis measures good Z. If the student decides to spend all his

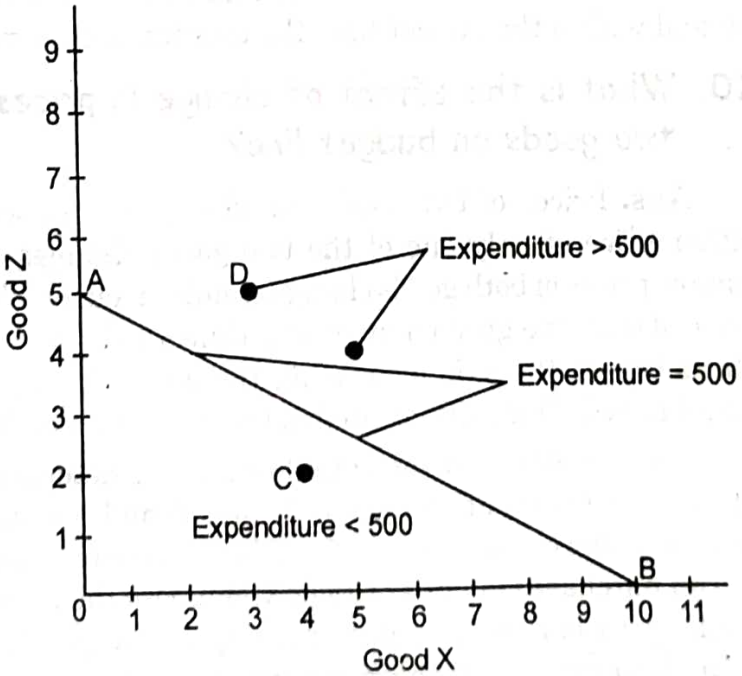

Fig. 6.13

income on good Z and nothing on good X, he can buy 5 units of Z and zero units of good This is given by point A.

If the student decides to spend all his income on good X and nothing on good Z, he ca buy 10 units of X and zero units of good Z. This is given by point B. If we join points A an B we get what is called budget line, the graph which shows the combinations of quantiti of the two goods a consumer can buy by spending all his given income, given the prices two goods.

Points A and B give the extreme cases in which the student buys only Z or only respectively. The points between these two extreme points, along the budget constrain represent the other possible combinations of quantities of good X and Z the cost of whic must add up to Rs 500.

All the combinations of good X and good Z on or inside the budget line are *attainabl or affordable* from the Rs 500 of money income and the given prices. The student ca afford to buy, for example, 3 notebooks at Rs 100 each and 4 ice creams at Rs 50 each. H also can obviously afford to buy 2 notebooks and 4 ice creams (point C), thereby using u only Rs 400 of the Rs 500 available. Thus, attainable combinations or opportunity set o the student includes all the combinations of quantities given by points on the budget lin and below it -the area of triangle AOB. However, to achieve maximum utility, the studen will want to spend the full Rs 500. The budget line shows all combinations that cost exactl the full Rs 500.

The opportunity set is also called the budget space. The budget space shows the set o combinations of quantities of two goods that can be purchased by spending the whole or a part of the given income.

In contrast, all combinations beyond the budget line are *unattainable or unaffordable*. The Rs 500 limit simply does not allow the student to purchase, for example, 5 notebooks at Rs 100 each and 3 ice creams at Rs 50 each (point D). That Rs 650 expenditure would clearly exceeds the Rs 500 limit. In the figure given above, the attainable combinations are on and within the budget line; the unattainable combinations are beyond the budget line.

10. What is the effect of change in prices of two goods on budget line?

Ans. Prices of two goods can change in two ways: either price of only one of the two goods changes at a time or prices of both goods change simultaneously. When price of only one good changes at a time, the budget line shifts but on the axis measuring the good whose price has changed. This is illustrated in the following Fig. 6.14:

Suppose AB is the original budget line determined by certain prices of the goods X and Z and a certain income. If the consumer spends all his income on good X, he can purchase OX1 quantity of X. Suppose the price of X falls, price of Z and income remaining unchanged. Now, with a lower price of X, the given income can buy a higher

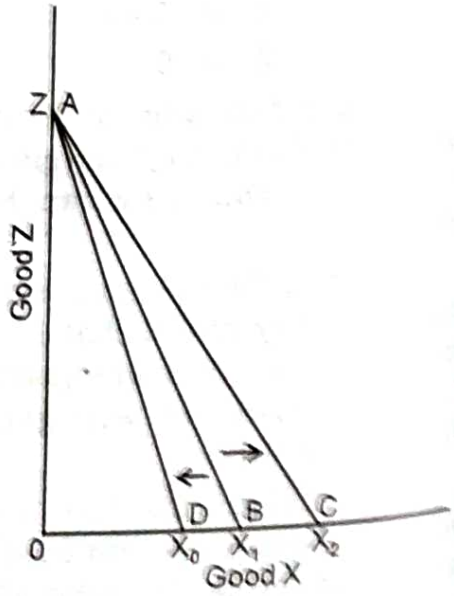

Fig. 6.14

quantity of X. Let this higher quantity be given by OX2 under the condition that the consumer spends all his income on good X only.

Because price of good Z and income do not change, the consumer can buy same quantity of Z (given by OZ_1) if he spends all his income on good Z only even in the new situation of lower price of X.

If we join point A and point C which gives the new affordable quantity of X at the new lower price, we get a new budget line given by AC.

Now suppose the price of good X rises from its original price, price of good Z and income remaining unchanged. With a higher price of X, the given income can buy a lower quantity of X. Let this lower quantity be given by OX_0 under the condition that the consumer spends all his income on good X only.

This change in price of good X will again have no effect on the maximum quantity of good Z if the consumer spends all his income on good Z only.

If we join point A and point D which gives the new affordable quantity of X at the new higher price, we get a new budget line given by AD.

This illustration shows that when the price of only one good changes, price of other good and income remaining unchanged, the budget line shifts on the axis measuring the good whose price has changed: it shifts away from the origin in case of a fall in price of the good indicating that the consumer can buy a higher maximum quantity of the good if he spends all his income on this good. The budget line shifts towards the origin in case of a rise in the price of the good indicating that the consumer can buy a lower maximum quantity of the good if he spends all his income on this good.

We can repeat the exercise to analyze the effect of changes in price of good Z on the budget line, price of good X and income remaining unchanged. The exercise will show that a fall in price of good Z will again shift the budget line away from the origin and a rise in price of good Z will once again shift the budget line towards the origin. But this shift will occur only on axis measuring good Z.

If prices of both goods fall simultaneously so that consumer can buy a higher maximum quantity of both the goods if he spends all his income on either of the good, the budget line will shift away from origin on both the axis. However, the extent of the shift will depend on the magnitude of the fall in price: the extent of the shift will be more on the axis measuring the good with a relatively higher fall in price. This is depicted in the following Fig. 6.15 on the assumption that prices of both the goods fall and fall in price of good Z is relatively higher.

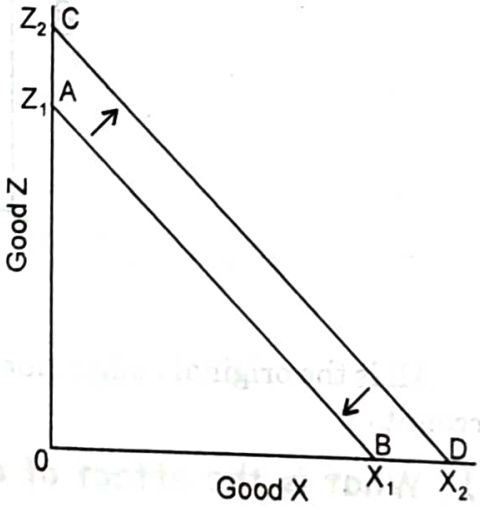

Fig. 6.15

If prices of both goods rise simultaneously so that consumer can buy a lower maximum quantity of both the goods if he spends all his income on either of the good, the budget line will shift towards the origin on both the axis. However, the extent of the shift will depend on the magnitude of the rise in price: the extent of the shift will be more on the axis measuring the good with a relatively higher rise in price. This

is depicted in the following Fig. 6.16 on the assumption that prices of both the goods rise and rise in price of good Z is relatively higher.

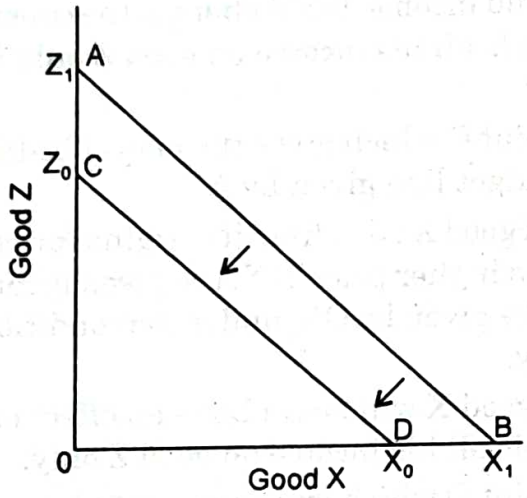

Fig. 6.16

If price of one good rises and that of other good falls, the budget line will shift away from origin on the axis measuring the good whose price has fallen and towards the origin on the axis measuring the good whose price has increased so that the new budget line obtained after the changes in prices have been accounted for will intersect the original budget line. This is depicted in the following figure which has been drawn on the assumption that price of good X has decreased and that of good Z has increased.

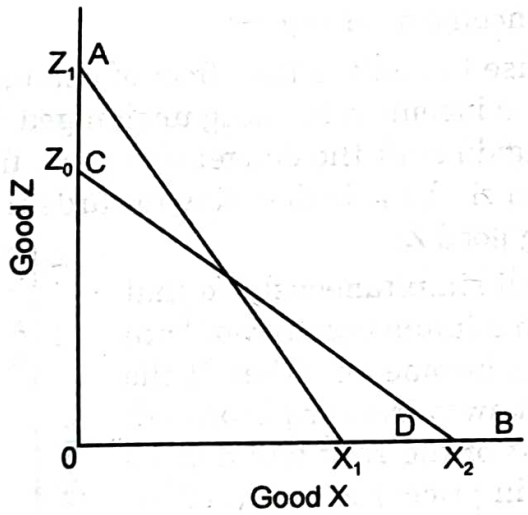

Fig. 6.17

AB is the original budget line. CD is the budget line after the change in prices is taken account of.

11. What is the effect of change in income of consumer on budget line?

Ans. If the income of the consumer changes, without any change in prices of the goods, budget line will shift on both the axis and the new budget line will be parallel to original axis: if the income rises, the budget line will shift away from origin on both the axis, and if the price falls, the budget line will shift towards the origin on both the axis. This is illustrated in the following diagram:

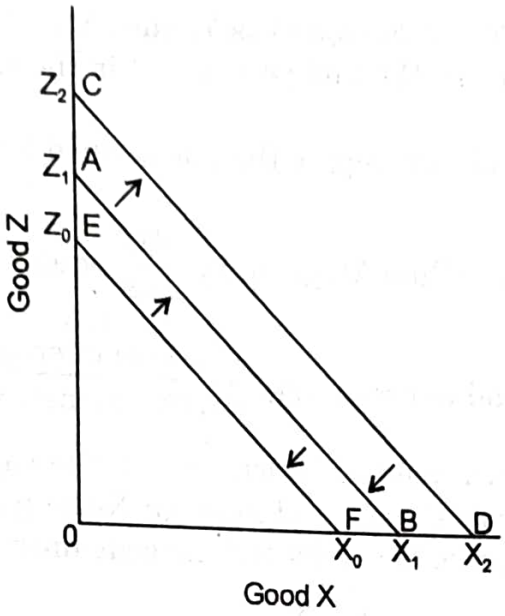

Fig. 6.18

Let AB be the initial budget line determined by certain prices and certain level of income. If the income of the consumer increases, prices of goods held unchanged, the consumer is able to purchase proportionately higher maximum quantities of both the goods if he spends all of his income on either of them.

Let us suppose that after increase in income, consumer can purchase OX_2 of X and OZ_2 of Z given by points C and D respectively (OX1 and OZ1 given by points A and B being the maximum affordable quantities at the initial income).

If we join the points C and D, we will get a new budget line depicting the budget constraint after the increase in income.

If the income of the consumer decreases, prices of goods held unchanged, the consumer is able to purchase proportionately lower maximum quantities of both the goods if he spends all of his income on either of them.

Let us suppose that after decrease in income, consumer can purchase OX_0 of X and OZ_0 of Z given by points E and F respectively. If we join the points E and F, we will get a new budget line depicting the budget constraint after the decrease in income.

12. Show that the slope of a budget line represents the ratio of the prices of two goods.

Ans. The fact that the slope of a budget line represents the ratio of the prices of two goods can be shown using the Fig. 6.19. given below:

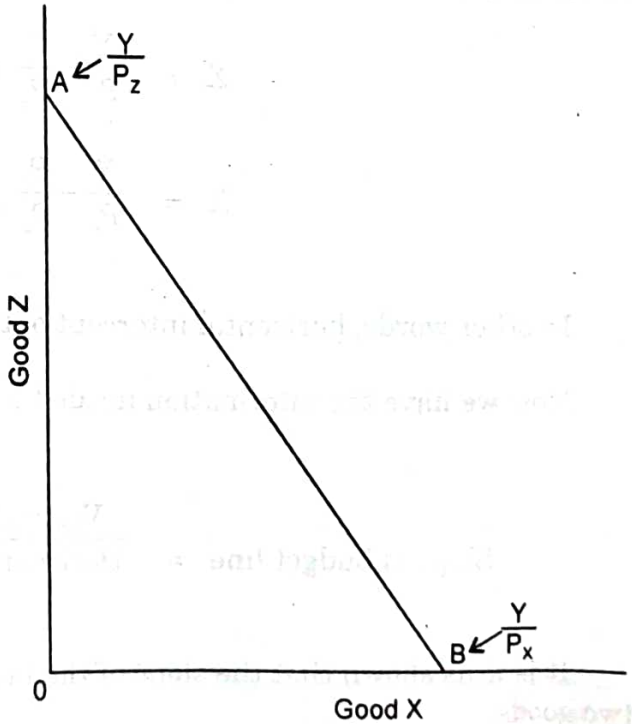

Fig. 6.19

Suppose the income given to consumer is Y, and Px and Pz are the prices of goods X and Z respectively. The slope of the budget line AB is the tangent of angle ABO which equals $\frac{AO}{OB}$, or simply vertical intercept of the line divided by its horizontal intercept. We intend to prove that the slope of line AB given by $\frac{AO}{OB}$ equals the ratio of the prices of two goods, $\frac{P_x}{P_z}$. In short, we intend to prove that $\frac{\text{Vertical intercept}}{\text{Horizontal intercept}} = \frac{P_x}{P_z}$

The vertical intercept is the point at which the consumer spends all his income on good Z-the good measured on vertical axis, and none on X-the good measured on horizontal axis, (that is, X = 0). In that case the units of Z the consumer consumes equal:

$$Z = \frac{Y}{P_z} - \frac{P_x}{P_z} Z$$

$$Z = \frac{Y}{P_z} - \frac{P_x}{P_z} . 0 = \frac{Y}{P_z}$$

In other words, vertical intercept of the line equals $\frac{Y}{P_z}$.

Similarly, the horizontal intercept is the point at which the consumer spends all his income on good X -the good measured on horizontal axis, and none on Z -the good measured on vertical axis, (that is, Z = 0). In that case the units of X the consumer consumes equal:

$$X = \frac{Y}{P_x} - \frac{P_z}{P_x} Z$$

$$X = \frac{Y}{P_x} - \frac{P_z}{P_x} . 0 = \frac{Y}{P_x}$$

In other words, horizontal intercept of the line equals $\frac{Y}{P_x}$.

Now we have the information needed to find the slope of the budget line. It is:

$$\text{Slope of budget line} = \frac{\text{Vertical intercept}}{\text{Horizontal intercept}} = \frac{\frac{Y}{P_z}}{\frac{Y}{P_x}} = \frac{Y}{P_z} \times \frac{P_x}{Y} = \frac{P_x}{P_z}$$

It is thus shown that the slope of the budget line equals the ratio of the prices of the two goods.

13. Explain consumer's equilibrium with the help of indifference curve technique.

Ans. A consumer is said to be in equilibrium when he is buying such a combination of goods which gives him highest possible level of satisfaction so that he is in a state of balance with regard to the money expenditure among various goods and has no reason to rearrange his purchases of goods.

To describe consumer's equilibrium with the help of indifference curve technique, we need following information

- The individual has an indifference curve map
- The individual faces a budget constraint

Along with the facts that

- The absolute value of the slope of the budget constraint gives the ratio of prices of the two goods under consideration, say, $\frac{P_x}{P_z}$
- The absolute value of the slope of the indifference curve at any point gives the marginal rate of substitution, which is equal to the ratio of the marginal utilities of two goods under consideration, say, $\frac{MUx}{MUz}$

The indifference curve map exhibits the consumer's scale of preferences for various combinations of two goods. Because the consumer is rational in the sense that his goal is the maximization of level of satisfaction obtained from the consumption of goods, he will try to move higher and higher on his indifference curve map for the reason that higher indifference curves indicate higher levels of utility. However, his movement to higher indifference curves is constrained by budget constraint which represents the combinations of two goods the consumer can purchase.

Given the above facts, the consumer's problem can be stated as follows:

The rational consumer's problem is to move to a point on the highest possible indifference curve given his budget constraint.

Diagrammatically, the solution to this problem is given by tangency condition which implies that a consumer will attain his equilibrium with regard to the purchase of the two goods under consideration when one of his indifference curves is tangent to his budget line. This is shown in the following diagram.

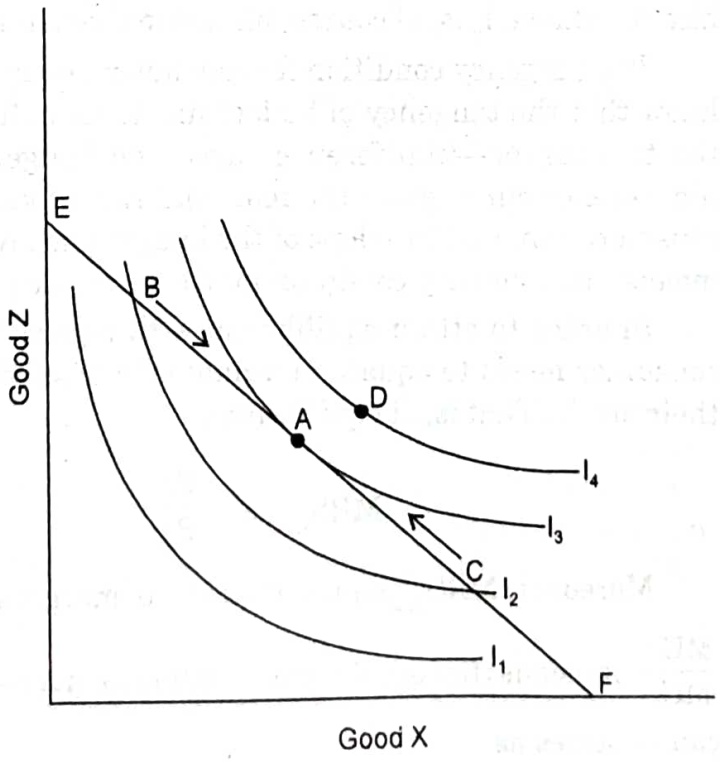

Fig. 6.20

The diagram shows several of indifference curves of a consumer labelled I_1, I_2, I_3, and I_4. The consumer would like to achieve the total utility level represented by I_4, the highest of the four curves, but he cannot afford to because he is constrained by his income: no consumption bundle on his budget line yields that much total utility.

But the consumer will not settle for the level of total utility generated by B, which lies on I_1 : there are other bundles on his budget line, such as A, that clearly yield higher total utility than B.

In fact, A is the consumer's optimal consumption choice. The reason is that A lies on the highest indifference curve the consumer can reach given the budget constraint (income and prices of goods) he faces.

At the optimal consumption bundle A, the consumer's budget line just touches the relevant indifference curve-the budget line is tangent to the indifference curve. This is the tangency condition for consumer's equilibrium under indifference curve technique.

There is another way to show that only the tangency point is the point of consumer's equilibrium or the point giving the optimal consumption bundle of the consumer. This is by showing that a consumption bundle that doesn't satisfy the tangency condition can't be optimal.

Re-examining the above figure, we can see that consumption bundles B and C are both affordable because they lie on the budget line. However, neither is optimal. Both of them lie on the indifference curve I_2 which cuts through the budget line at both points. But because I_2 cuts through the budget line, the consumer can do better: he can move down the budget line from B or up the budget line from C, as indicated by the arrows. In each case, this allows him to get onto a higher indifference curve, I_3 which increases his total utility.

The consumer cannot, however, do any better than I_3 : any other indifference curve either cuts through his budget line or doesn't touch it at all. And the bundle that allows him to achieve I_2 is, of course, his optimal consumption bundle.

The tangency condition for consumer's equilibrium can be stated in another way. We know that the tangency of budget line to an indifference curve implies that the slopes of the two curves—indifference curve and budget line—are equal. Now the slope of an indifference curve gives the marginal rate of substitution between the two goods under consideration, and the slope of the budget line gives the ratio of prices of the two goods. It means, the tangency condition for consumer's equilibrium can also be stated as follows:

In order to attain equilibrium with regard to the purchase of two goods X and Z, a consumer needs to equate marginal rate of substitution between them with the ratio of their prices. That is, at equilibrium:

$$MRS_{x,z} = \frac{P_x}{P_z}$$

Moreover, $MRS_{X,Z}$ equals the ratio of marginal utilities of two goods. That is, $MRS_{X,Z} = \frac{MUx}{MUz}$. It means the equilibrium condition for a consumer under indifference curve technique can be states as

$$\frac{MUx}{MUz} = \frac{P_x}{P_z}$$

Rearranging the above expression we have

$$\frac{MU_x}{P_x} = \frac{MU_z}{P_z}$$

This is the same result one obtains from cardinal utility analysis. That is to say indifference curve arrives at the same result regarding the optimal distribution of expenditure by a consumer across goods as that arrived by cardinal utility analysis. But the merit of indifference curve technique is that it arrives at this result but with less restrictive assumptions.

14. Derive a demand curve with the help of indifference curve technique of describing a consumer's equilibrium.

Ans. A demand curve shows the quantity demanded of a good for any given price. We can view a consumer's demand curve as a summary of the optimal decisions that arise from his budget constraint and indifference curves. In this way, the theory of consumer choice provides the theoretical foundation for the consumer's demand curve.

In order to derive a consumer's demand curve for some product, we need to analyse the effects of changes in the price of that product on the consumer's demand for that product, everything else including prices of other goods being held constant

Panel (*a*) of the following Fig. 6.21, shows a consumer's utility-maximizing solution for good X and Z. He achieved it by selecting a point at which an indifference curve was tangent to his budget line. A change in the price of one of the goods, however, will shift his budget line. By observing what happens to the quantity of the good demanded whose price changes, we can derive the consumer's demand curve.

Panel (*a*) of the above figure shows the original solution at point E with the budget line JK determined by certain level of income (Y), certain prices of goods X and Z, say, PX_2 and PZ_2, respectively. Now suppose the price of good X falls, say, from PX_2 to PX_1, price of good Z and income remaining unchanged. That changes the horizontal intercept of the budget line so that we have a new budget line JL; if the consumer spends all of his money on good X, he can now purchase X_2 quantity of good X which is more than X_1 which he would have purchased before the price fall.

Another way to think about the new budget line is to remember that its slope is equal to the negative of the price of the good on the horizontal axis divided by the price of the good on the vertical axis. When the price of good X (the good on the horizontal axis) goes down, the budget line becomes flatter. The consumer picks a new utility-maximizing solution at point B. The solution at B involves an increase in the quantity of good X from X_1 to X_2.

At a price of PX_2, the consumer maximized utility at point A, as reflected by the tangency of budget line MN_2 with indifference curve I_2, consuming X_1 of good X. When the price falls to PX_1, he maximizes utility at point B, as reflected by the tangency of new budget line MN_1 with indifference curve I_3, consuming X_2 of good X.

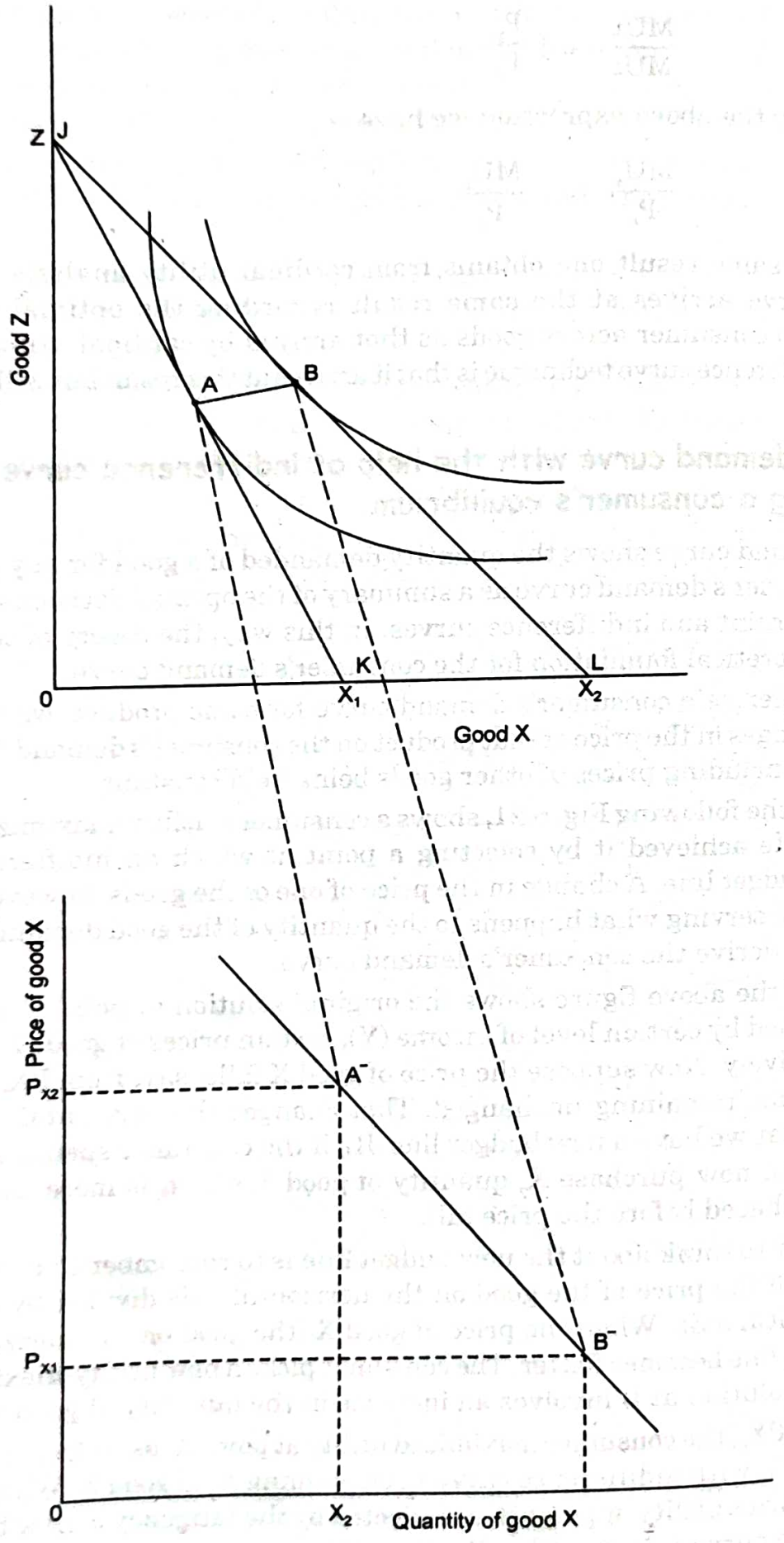
Z
J
Good Z
A
B
K
L
0
X_1
X_2
Good X
Price of good X
P_{X2}
P_{X1}
A
B
0
X_2
Quantity of good X

Fig. 6.21

If we join the tangency points between the various budget lines and indifference cures, the line joining these points is called price consumption curve; the line showing the amounts of a good demanded in equilibrium at various prices. In the diagram, the price consumption curve for good X is given by the line labelled AB.

Plotting the quantity of good X that the consumer consumes for the specific budget line at any given price yields one point on his demand curve. Every other possible price yields a different point. The resulting price-quantity combinations trace out the consumer's whole demand curve.

The price-quantity combinations of $P_{X_2.X_1}$ and $P_{X_1.X_2}$ given by points A and B in panel (*a*) are plotted as points A′ and B′ in panel (*b*) of the diagram. By joining points A′ and B′ in panel (*b*) we derive the consumer's demand curve for good X-the graphical representation of the fact that other things held unchanged, at higher price a lower quantity is demanded and a lower price a higher quantity is demanded, that is, as price falls, quantity demanded rises.

Notice that only the price of good X has changed, all other features of the utility-maximizing solution remaining the same. The consumer's budget and the price of good Z are unchanged; this is reflected in the fact that the vertical intercept of the budget line remains fixed. The consumer's preferences are unchanged; they are reflected by his indifference curves.

15. Compare cardinal utility approach of studying consumer behaviour to the indifference curve approach.

Ans. Indifference curve approach to the study of consumer was put forward as an alternative to the Marshallian cardinal utility analysis. Naturally, indifference curve approach has many advantages over cardinal utility analysis. Some of these include:

(*i*) In contrast to the cardinal approach which assumes quantitative measurement of utility, indifference curve approach is more realistic in assuming ordinal measurement of utility.

(*ii*) Similarly, the assumption of independence of utilities which is another basic assumption of cardinal utility analysis and is an unrealistic one, is given up under indifference curve approach.

(*iii*) Unlike cardinal utility approach, under indifference curve approach there is no need to assume marginal utility of money to be constant as there is no need to use money as a unit of measurement for utility because indifference curve approach rightly considers utility to be a non measurable phenomenon.

(*iv*) Indifference curve approach arrives at the same conclusion about the utility maximising behaviour of a consumer as the cardinal utility analysis. but in doing so indifference curve approach assumes less and whatever assumptions it makes are less restrictive and more real than those of cardinal utility approach.

Despite this superiority of indifference curve approach over cardinal utility approach, there are some striking similarities between the two. Some of these include:

(*i*) The assumption of consumer rationality which means consumer seeks to maximise his level of satisfaction is a common assumption of the two approaches.

(*ii*) Both the approaches employ psychological or introspective method of reasoning which involves attributing a certain psychological feeling to the consumer by looking into and knowing from ones own mind.

(*iii*) Both the approaches use deductive method of reasoning which involves observing individual events to arrive at generalisations.

(*iv*) Cardinal as well as indifference approaches to utility analysis employ the concept of 'margin'. In cardinal utility analysis, marginal utility is a basic concept. Similarly, under indifference curve approach marginal rate of substitution is the basic concept.

(*v*) Some form of diminishing marginal utility is assumed in both the approaches. The diminishing marginal rate of substitution which is the basis for convexity of indifference curves is equivalent to the law of diminishing marginal utility of cardinal utility analysis. this can be shown with the help of the following diagram as follows:

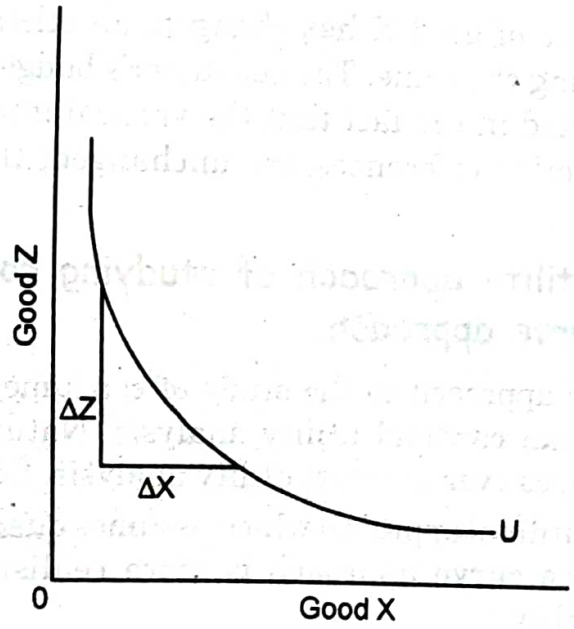

Fig. 6.22

The diagram gives an indifference curve U which shows the consumption of two goods, X and Z, by a particular consumer. Suppose the consumer changes the level of consumption of X and Z by ΔX and ΔZ, respectively. The corresponding impact on utility ΔU will be equal to change in X multiplied by marginal utility of X plus change in Z multiplied by marginal utility of Z. That is,

$$\Delta U = MUx(\Delta X) + MUz(\Delta Z)$$

But it must be that ΔU = 0, because changes in X and Z that move the consumer along the indifference curve U must keep utility unchanged. So

$$0 = MUx(\Delta X) + MUz(\Delta Z)$$

This can be rewritten as

$$MUz(\Delta Z) = -MUx(\Delta X)$$

Or

$$-\frac{MUx}{MUz} = \frac{\Delta Z}{\Delta X}$$

Or $$-\frac{MUx}{MUz} = \frac{\Delta Z}{\Delta X}$$

This means the (negative) slope of an indifference curve of two goods X and Z, $\left(-\frac{\Delta Z}{\Delta X}\right)$ equals the ratio of the marginal utilities of the two goods $\left(\frac{MUx}{MUz}\right)$

Finally, since marginal rate of substitution between X and Z (MRSx, z) is the negative of the slope of the indifference curve, that is,

$$-\frac{\Delta Z}{\Delta X} = MRSx, z$$

We observe that $$-\frac{\Delta Z}{\Delta X} = MRSx, z = \frac{MUx}{MUz}$$

(*iv*) The most striking similarity between the two approaches is that despite different sets of assumptions they arrive at the same conclusion about the utility maximising behaviour of a consumer.

In order to attain equilibrium with regard to the purchase of two goods X and Z under indifference curve approach, a consumer needs to equate marginal rate of substitution between them with the ratio of their prices. That is, at equilibrium:

$$MRSx, z = \frac{P_x}{P_z}$$

Moreover, $MRS_{X, Z}$ equals the ratio of marginal utilities of two goods. That is, $MRS_{X, Z} = \frac{MU_X}{MU_Z}$. It means the equilibrium condition for a consumer under indifference curve technique can be states as

$$\frac{MU_X}{MU_Z} = \frac{P_x}{P_z}$$

Rearranging the above expression we have

$$\frac{MU_X}{P_x} = \frac{MU_Z}{P_z}$$

This is the same result one obtains from cardinal utility analysis.

16. Critically evaluate indifference curve approach to the study of consumer behaviour.

Ans. Indifference curve approach to the study of consumer was put forward as an alternative to the Marshallian cardinal utility analysis. Naturally, indifference curve approach is superior to cardinal utility analysis in many ways. (For further details on this topic refer to Question No 15 above).

Despite this superiority of indifference curve approach over cardinal utility approach, there are many limitations and shortcomings from which it suffers. Some of these include:

(*i*) One of the basic assumptions of indifference curve approach is that the consumer possesses complete knowledge of all his scale of preferences or that he has an indifference map before him. But this assumption is regarded very restrictive and unrealistic. This assumption was so unrealistic that it led John Hicks, the theorist of indifference curve approach, to revise his theory of demand.

(*ii*) The indifference curve analysis like the cardinal utility analysis assumes that the consumer acts rationally. The consumer is of a calculating mind who carries innumerable calculations in his mind, can compare total utilities of different commodities, and finally make a rational choice. This is too much to expect from a consumer who acts under various social, economic and other constraints.

(*iii*) The assumption of perfect competition on which indifference curve analysis is based is also unrealistic. In reality, a consumer is faced with markets other than perfect competition, particularly monopolistic competition and oligopoly.

(*iv*) Indifference curve analysis failed to consider many factors other than price, income, preferences etc concerning consumer behaviour. Indifference curve analysis does not consider snob, veblon or bandwagon effects which result in interdependence of preferences of consumers, nor does it effects of advertising and other sales promotion strategies. Similarly, indifference curve analysis give no attention to speculative demand.

(*v*) Indifference curve analysis also assumes that goods are divisible in small units. But not all goods are divisible. When indivisible goods like cars, mobiles, watches, computers etc are considered, indifference curve analysis fails to provide satisfactory explanations of consumer behaviour.

(*vi*) Another weakness of indifference curve approach is that it fails to analyse consumer's behaviour under uncertainty and the situations involving risk.